

• • **Revision History**

Revision	Date	Reason for change
1.0	July 2009	Initial release of product.

Caution!

Caution!

- This manual contains necessary information to operate the system safely. Please read this manual before attempting to use the system.
- Read Chapter 1 first. Review this chapter before start operating this system.
- Due to frequent software update, your system may be configured slightly differently from what are introduced in this book.

Regulatory Requirement

This product complies with regulatory requirements of the following European directive LVD & EMC.



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System Safety

1.1 Safety Overview

This chapter discusses the measures concerning the safety of the patient and the operator. To ensure the safety of the operator and the patient, please read this chapter carefully before operating this system. Warning information, also provided in this manual, should be followed carefully. Any violation of the relevant rules may result in personal injury or even endanger human life.












The following precautions should be adhered to:

- This system shall be operated only by or under the guidance of a qualified person.
- This system complies with Type B general equipment, Class I of EN606601-1:1990 + A1:1993 + A2:1995 standard.
- There are no user-adjustable parts inside the system. Under no circumstances should this equipment be modified. Any modifications must be made by the technicians authorized by the manufacturer.
- In case of system malfunction, turn off the power supply immediately and inform our representative nearest to you.
- The power cable of the system must be connected to a power socket which has an effective earth pin.
- Connect this system, either electronically or mechanically, only with the devices complying with the EN606601-1:1990 + A1:1993 + A2:1995 standard. Recheck the leakage current and other safety performance indices of the entire system to avoid potential system damage caused by leakage from a current superposition.
- The equipment has no specialized design to enable it working with high frequency devices. It may interfere with or be interfered by other high frequency devices (e.g. medical lasers). Extra safety measures must be taken if other HF devices have to be used nearby.
- While the system is designed to provide diagnostic information, it is the operator's responsibility to ensure that this information is properly interpreted. The manufacturer shall not assume any responsibility for the misinterpretation of ultrasound images.
- We recommend back up any important data on the system to external media, such as USB drive and CD/DVD. The manufacturer shall not be responsible for any data loss (including but not limited to the patient data) due to malfunction.
- The installation shall be performed only by the personnel authorized by the manufacturer. Do not attempt to install the system by yourself.
- Repair service shall be performed only by the service technicians authorized by the manufacturer.

1. SYSTEM SAFETY

- To avoid the danger of explosion, never operate the system in the presence of flammable gases.
- Power off the system before cleaning. Protect the system from water or other liquid drops.
- To ensure the safety of the patient, prolonged continuous scan on the same part of the patient is prohibited.
- Apply the coupling gel which is bio-compatible on the transducer surface or the patient skin before an ultrasound scan. To ensure safety, only the legal marketed coupling gel complying with the relevant standards should be used.
- For the proper disposal of this product at the end of its lifetime, contact SonoScape or local representative of SonoScape.

1.2 Symbols

Symbol	Description
	Dangerous electric voltage
	Warning! Follow these instructions to avoid personal injury or system damage.
	Attention! Follow these instructions to avoid system damage.
	Off (Main power switch OFF)
	On (Main power switch ON)
	Protective earth/ground connection.
	Potential equilibrium connection
	AC
	Type B applied part
	Non-ionization radiation: Ultrasound scanner transmits acoustic waves.
	Warning! Do not use the system with the presence of inflammable gases, including inflammable anesthetics.

1.3 Ultrasound Safety

In order to discuss about ultrasound safety, the biological effects associated with the ultrasound should be understood first. Note that it's the user's responsibility to properly interpret the output display and avoid unnecessarily exposing the patient to ultrasound energy.

Subsection 1.3.1 discusses the mechanisms that generates the biological effects and the output display (including the output indices); Subsection 1.3.2 discusses the guideline cited from AIUM and recommended by FDA.

1.3.1 Biological Effects

The following two biological effects should be thoroughly understood by the user.

Heating (thermal effect):

Elevating tissue temperature during obstetrical examinations creates medical concerns. At the embryo development stage, the rise in temperature and the length of time exposed to heat combine to determine potential detrimental effects. Exercise caution particularly during Doppler/Color exams.

The Thermal Index (TI) provides a statistical estimate of the potential temperature elevation (in centigrade) of tissue temperature. Three forms of TI are available: TIS, for soft tissue exposures; TIB, for instances when bone lies near the beam focus; and TIC, for the heating of bone situated close to the transducer.

Cavitation (mechanical effect):

Cavitation may occur when sound passes through an area that contains cavities, such as gas-filled bubbles or air pocket (in the lung or intestine, for example). During the process of cavitation, the sound wave may cause the bubble to contract or resonate. This oscillation may cause the bubbles to rupture and damage the tissue. The Mechanical Index (MI) has been created to help users accurately evaluate the likelihood of cavitation and the related adverse effects.

It should be noticed that the acoustic output and the thermal and mechanical indices vary with some parameters, such as the number of focal zones, the depth of focus, the choice of B mode, M mode or Doppler mode, and etc.

1.3.2 ALARA - Principle of Diagnostic Ultrasound

Exposure time and acoustic output applied to the patient should be limited by following these rules:

- Freeze the system or keep the probe away from the patient if no scanning is performed.
- Do not scan the patient at a fixed position of the body for a prolonged time.

This product should be used only for valid reasons and should be used both for the shortest period of time and at the lowest power settings necessary (**ALARA** - As Low As Reasonably Achievable) to produce diagnostically acceptable images.

The AIUM also offers the following guidelines:

Clinical Safety Quoted from AIUM Approved March 26, 1997

Diagnostic ultrasound has been in use since the late 1950s. Given its known benefits and recognized efficacy for medical diagnosis, including use during human pregnancy, the American Institute of Ultrasound in Medicine herein addresses the clinical safety of such use:

There are no confirmed biological effects on patients or instrument operators caused by exposures from present diagnostic ultrasound instruments. Although the possibility exists that such biological effects may be identified in the future, current data indicate that the benefits to patients of the prudent use of diagnostic ultrasound outweigh the risks, if any that may be present.

For more detailed discussion about safety of diagnostic ultrasound, refer to *Medical Ultrasound Safety*, AIUM 1994.

1.4 Requirements for Operation

- Environmental requirements:
 - Relative humidity:** 30 ~ 75 %, no condensation
 - Temperature:** 10 ~ 40 °C
 - Barometric Pressure:** 700 ~ 1060 hPa
- Strong electromagnetic (EM) waves may interfere with the system and cause ghosting or noise on the screen. The system should be shielded from any strong EM waves and kept away from any strong radiation sources.
- Keep the objects or devices used for the ultrasound scan tidy and clean. Do not leave any objects (e.g., manuals, transducers) on the keyboard.
- When the system is not in use, be sure to turn off the power supply. Protect the system from dust by covering it with a dust cover.

1.5 Environmental Requirements for Transport and Storage

Relative humidity: 20 ~ 90%, no condensation
Temperature: -20 ~ 55 °C
Barometric Pressure: 700 ~ 1060 hPa

1.6 Electrical Requirements

- Power Requirements: 100-240V~, 50/60Hz
- Power Consumption: 130 VA
- Supply voltage: The maximum fluctuation should be within ± 10 %, otherwise the system can be damaged.
- Grounding: Before connection to the power supply, connect the system to the protective earth using the ground wire supplied with the system.

Note:

To avoid damaging the system, ensure to use the power supply which meets the above requirements.

Mains voltages and frequencies in different countries or regions may vary. Power requirements are also indicated on the rear panel next to the mains power input socket.

1.7 Electrical Safety Classification

- This system complies with Type B, Class I EN606601-1:1990 + A1:1993 + A2:1995, continuous operation.
Avoid using the system in the presence of inflammable gases (esp., inflammable anesthetics).

- Degrees of protection against harmful liquid:
 - For the main system:** IPX0
 - For the transducer:** IPX7, from the acoustic window to the junction line (Figure 6.1);
and IPX1 for other parts that may contact with the patient, excluding the transducer connector.
- This system conforms with the following EMC/EMI standards: IEC60601-1-2: 2001 + A1: 2004, Class A (CE).
Protective earth should be used to protect the system from AC power supply interferences.

System Description

2.1 General



Figure 2.1: System Overview

This ultrasound system is a full digital B/W diagnostic ultrasound equipment with high performance. With the state of the art design and the utilization of high performance super large scale integration (SLSI), this system is extremely capable of acquiring the acoustic information of human tissues. Accompanying the advanced hardware design is the Linux system, specifically optimized for medical use; it serves as the solid back end for a wide range of professional medical-application packages and the ease-of-use graphical user interface (GUI).

Compared to the conventional LCD monitors, the industrial-grade LCD monitor installed on the system supports the display of ultrasound images with higher resolution and has more grayscale levels, and it also weighs less, reducing the weight of the whole ultrasound system.

Software updates are provided regularly. Upgrades can be done effortlessly through the standard IO ports thanks to the use of specialized and versatile operating system in use.

2.2 Applications

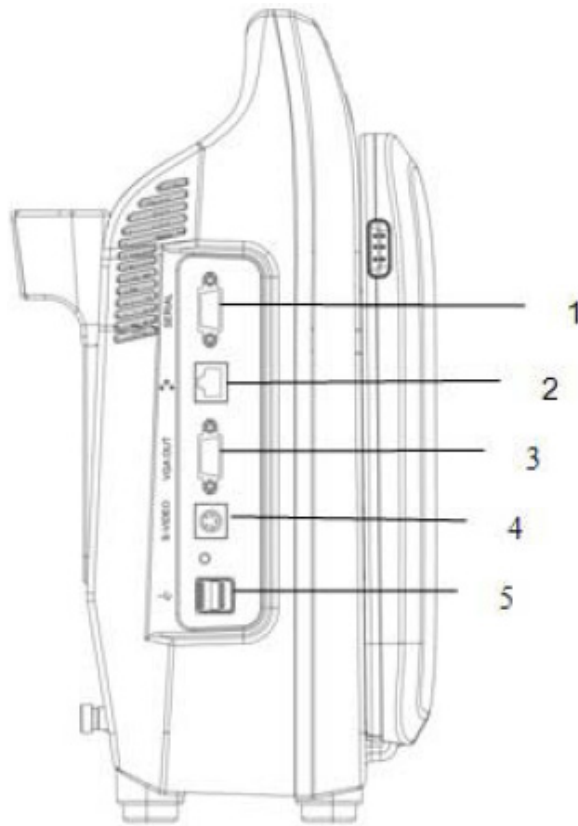
This system uses electronic scan and has a large selection of supported broadband transducers. Equipped with these transducers, the system is suitable for most clinical ultrasound diagnoses. Some typical applications are listed below.

- Small parts (breast, thyroid, testes, etc.)
- Gynecology
- Obstetrics (equine, feline, ovine, bovine and canine)
- Cardiology
- Urology

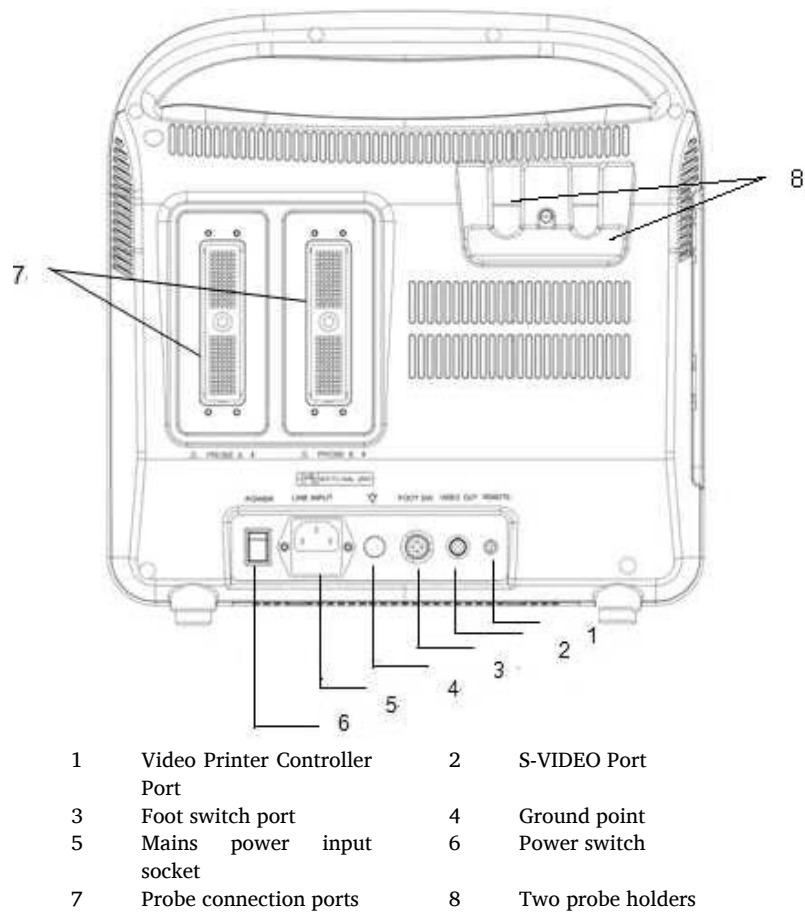
2.3 Contraindication

The system is not intended for OPTHALMIC use or any use that causes the acoustic beam to pass through the eye(s).

2.4 System Configuration



- | | | | |
|---|---------------|---|---------------|
| 1 | RS232 port | 2 | Ethernet port |
| 3 | VGA port | 4 | S-VIDEO port |
| 5 | Two USB ports | | |



2.4.1 Standard Configuration

Main unit	1 pc
Power cable	1 pc
Transducers	Provided as the user's request.
Protective-earth wire	1 pc
Fuse 1.6A/250V	2 pcs
S-VIDEO cable	1 pc
BNC video cable	1 pc
USB2.0 cable	1 pc
VGA video cable	1 pc
Coupling gel	1 bottle

2.4.2 Optional Accessories

- DVD writer
- Docking cart
- Backpack
- Foot switch
- Biopsy guide
- Additional transducers

2.4.3 Optional Peripherals

USB2.0 disk drive
USB2.0 removable hard disk drive
USB2.0 CD/DVD writer
USB2.0 video printer
Composite video printer
Network printer
VCR

System Operation

3.1 Operation Notice

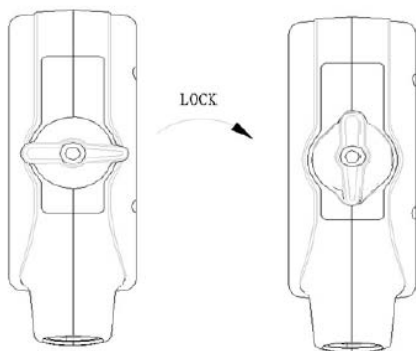


Warning!

1. The system shall be operated by a trained sonographer.
2. Before using this system, please make sure that this manual has been read and properly understood.

3.2 Transducer Connection

The transducer ports are at the back of the system.



Instructions:

- Plug the probe into the probe socket.
- Turn the lock on the transducer clockwise to lock the transducer in position.



Attention!

Either freeze the ultrasound image by pressing FREEZE or turn off the system before connecting or removing a transducer.

3.3 Power ON/OFF



Warning!

Review Chapter 1 and ensure it has been properly understood before you turn on your ultrasound system.

Before the system is powered on, please make sure that:

1. The power supply meets the requirements for proper operation of this system.
2. The system is effectively grounded by grounding the protective earth pin using the protective earth wire provided with the system.
3. The power switch on the rear panel is set to OFF.

Power supply connection

Connect the system to the power supply with the power cable supplied with the system.

Turn on the system

When the power supply is connected, press the power switch on the rear panel to turn on the system. Once the system is turned on, the keyboard will be illuminated, and the splash screen with the logo will appear. The initialization takes about 1 minute to complete before the EXAM interface appears.

Turn off the system

Switch the power switch on the rear panel to OFF, and the system will be turned off immediately.

Note:

After powering off the system, wait for a least 5 seconds before restarting. In case that the system is restarted too often, the power supply's self protection mechanism will be activated to protect the system.

3.4 Keyboard Functions

This ultrasound system uses backlight control panel; the layout of the keys has been optimized, such that complicated operations can be easily accomplished.

The control panel, shown in Figure 3.1, includes the alphanumeric keyboard, 6 control keys, and 23 function keys, 3 knobs (FUNC, MENU, GAIN), and 8 TGC slider controls.

Item	Key	Description
(1)	Exam	Return the system to the preparation mode (EXAM screen).
(2)	Patient	Access the Patient Information interface.
(3)	Comment	Insert comments.
(4)	File	Go to disk management system.
(5)	Clipboard	Go to clipboard function
(6)	THI	Tissue Harmonic Imaging
(7)	Freq.	Change transducer frequency
(8)	Alphanumeric keyboard	Input characters or numbers. Press Clear to clear the screen.

continued on next page ...

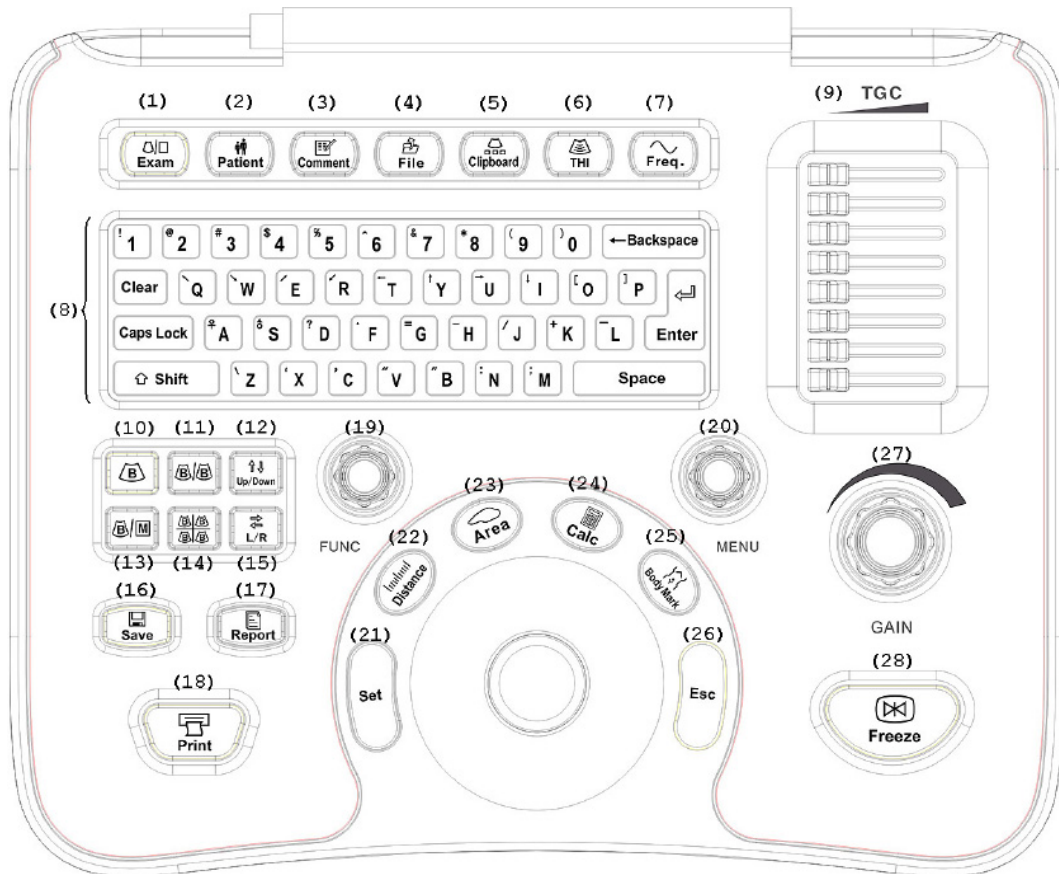


Figure 3.1: Control panel

Item	Key	Description
(9)	TGC	Adjust variable gain of the amplification applied to the echoes.
(10)	B	Return to B Mode.
(11)	B/B	Activate the dual B mode, or switch the selection to be activated between left and right.
(12)	Up/Down	Flip the image vertically
(13)	B/M	Switch between B/M and full M mode
(14)	4B	4B mode
(15)	L/R	Flip the image horizontally
(16)	SAVE	Save application mode, or save image or cine.
(17)	REPORT	Activate the REPORT interface.
(18)	Print	Print the current screen.
(19)	FUNC	Press this knob to change the current active function. Turn this knob to change the parameter of the active function.

continued on next page ...

3. SYSTEM OPERATION

Item	Key	Description
(20)	MENU	Press this knob to activate the system setup menu or the ultrasound diagnosis context menu. Turn this knob to adjust value of the selected parameter in the menu.
(21)	Set	This key serves as a confirmation key.
(22)	Distance	Measure the distance between two points.
(23)	Area	Press this key and draw a closed trace, the area enclosed will be automatically calculated and displayed.
(24)	Calc	Activate the B mode or the M mode calculation menu
(25)	Bodymark	Insert symbols of body parts.
(26)	Esc	Cancel the previous operation or reduce the value of the selected parameter.
(27)	GAIN	Adjust B or M mode gain.
(28)	Freeze	Freeze or unfreeze the image.

3.5 User Interface

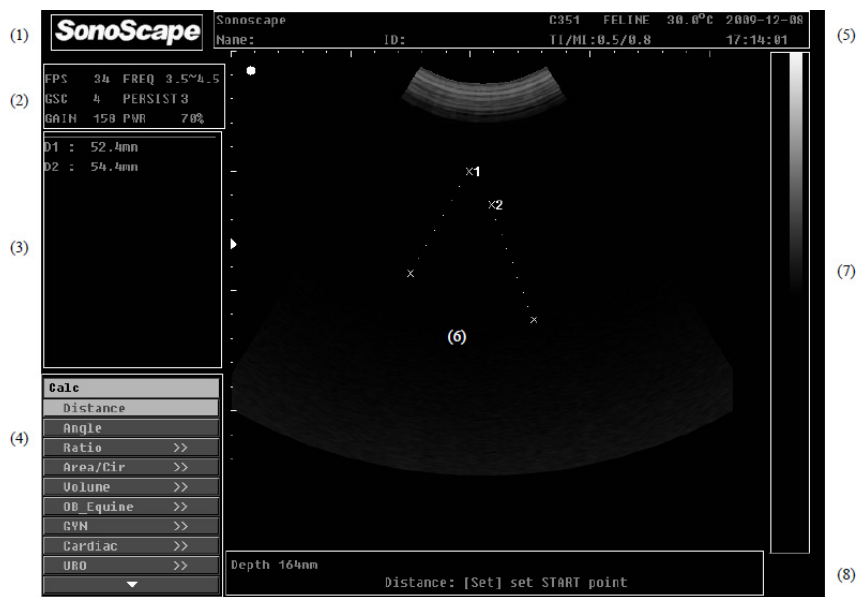


Figure 3.2: User interface of application mode

The user interface of the application mode is shown in Figure 3.2. It can be divided into 8 areas, showing the following information:

1. Logo
2. Image information
3. Measurement and calculation results
4. Context menu
5. Patient information, system time and etc.
6. Ultrasound image
7. TGC curve and grayscale bar
8. Notification area: it displays the notification for current operation, USB connection status, and etc.

3.6 System Setting

In the preparation mode (EXAM screen), press **MENU** to activate the **System Setting** interface. Press **MENU** again or click **Exit** to close the **System Setting** window.

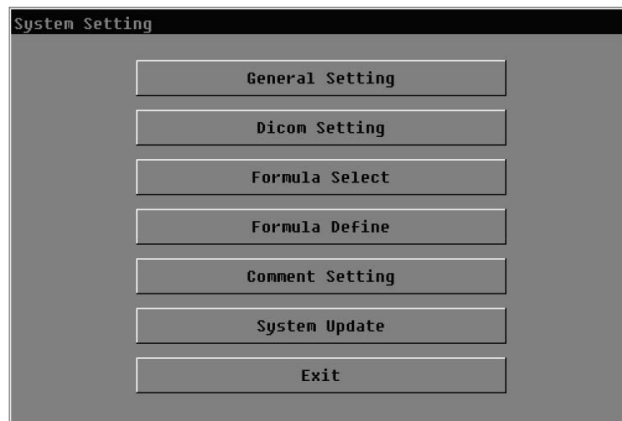


Figure 3.3: System Setting

The rest of this section explains how to customize the system using the items listed in the System Setting interface.

3.6.1 General Setting

At the **System Setting** window, click **General Setting** to activate the **General Setting** window.

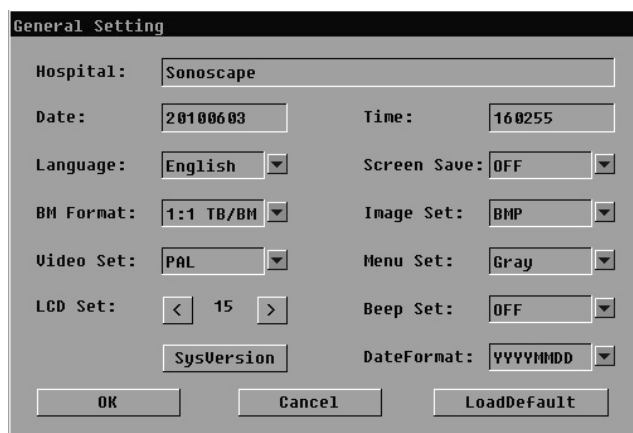


Figure 3.4: General Setting

The options in General Setting are explained below:

Hospital Name

Type in the hospital or department name with no more than 40 characters.

Date	Enter the date in the YYYYMMDD format.
Time	Enter the time in the HHMMSS format.
Language	Select the language of the GUI from the dropdown list. You need to restart the system for the change to take effect.
Screen Save	Change the time to wait before the screen saver starts. Set to OFF to disable the screen saver.
BM Format	From this dropdown list, select the default layout used in the B/M dual mode.
Image Set	Set the image format for saving: JPG, BMP or DCM.
Video Set	Set the analog video encoding system to NTSC or PAL.
Menu Set	Menus can be set to appear in grayscale or color.
LCD Set	Click the triangular-bracket button or turn MENU to change the LCD brightness.
SysVersion	Click this button to view the system information.
Beep Set	Set it to ON to enable the beep sound effect.
DateFormat	Set the date format for the clock displayed on screen.
OK	Save changes and exit.
Cancel	Exit without saving changes.
Load default	Discard the current setting and load the default setting.

3.6.2 Dicom Setting

At the **System Setting** window, click **DICOM Setting** to activate the **DICOM Setting** window.

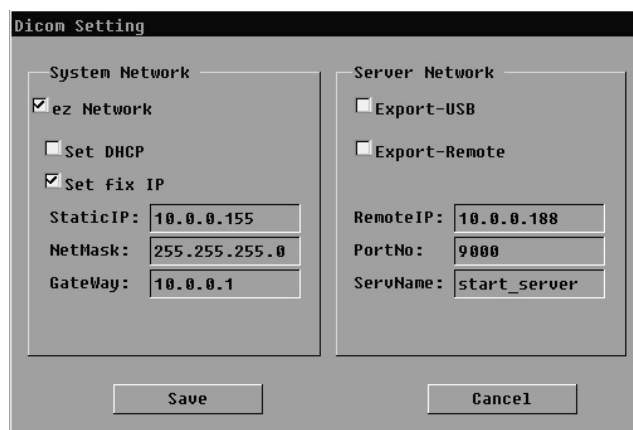


Figure 3.5: Dicom Setting

The items in DICOM Setting are explained below:

System Network

ezNetwork	Check this option, otherwise network support for the ultrasound system will be disabled.
Set DHCP	Check this option to use the Dynamic Host Configuration Protocol (DHCP) to retrieve the configuration information from the server.
Set fix IP	Manually set the network addresses. If this option is checked, you need to provide the local static IP address, the NetMask, and the Gateway addresses.
Server Network	
Export-USB	Check this option to enabling exporting data to USB.
Export-Remote	Check this option to enable DICOM data transfer through network. You need to enter the server IP address, the server port number, and the server name.
Save	Save changes and exit.
Cancel	Discard changes and exit.

3.6.3 Formula Select

The screenshot shows a 'Formula Select' dialog box with two columns of settings. The left column is for 'EQUINE' and the right column is for 'CANINE'. Each column has four rows of settings: GS, HD, BD, and BPD. Each row has a label and a dropdown menu set to 'DEFAULT'. At the bottom, there are three buttons: 'Save', 'Exit', and 'LoadDefault'.

Figure 3.6: Formula selection

At the **System Setting** window, click **Formula Select** to activate the formula selection window.

Select the formulae from the drop-down lists. Click **LoadDefault** to load the default formulae for all measurement items.

Click **Save** to save the settings and exit.

Click **Exit** to exit without saving.

3.6.4 Formula Define

At the **System Setting** window, click **Formula Define** to activate the **Formula Define** window. You can create new formula tables here.

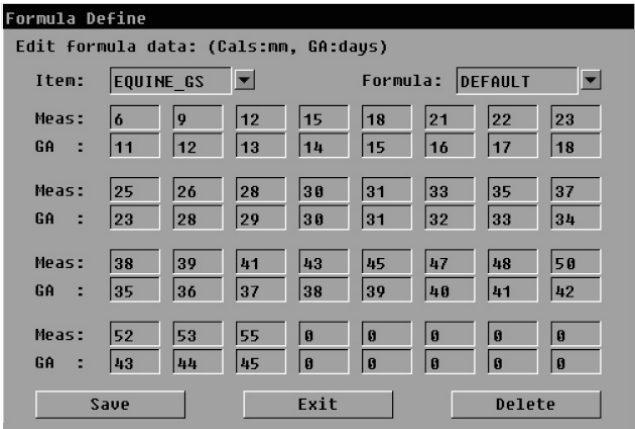


Figure 3.7: Create formula table

- Item** Select the measurement item to be edited from the dropdown list.
- Formula** Select the formula table that your new table will be based on.
- Meas** The measurement values, should be set from the minimum to the maximum, and can have up to 32 different values.
- GA** Set the respective GA values at the corresponding distance.
- Save** To save the formula table, click this button and enter a name in the popup dialog box. The system automatically adds 'U' in front of the name.
- Exit** Discard changes and exit.
- Delete** Delete the selected formula table. Only the user-defined formula table can be deleted.

3.6.5 Comment Setting

At the *System Setting* window, click **Comment Setting** to activate the *Comment Define* window.

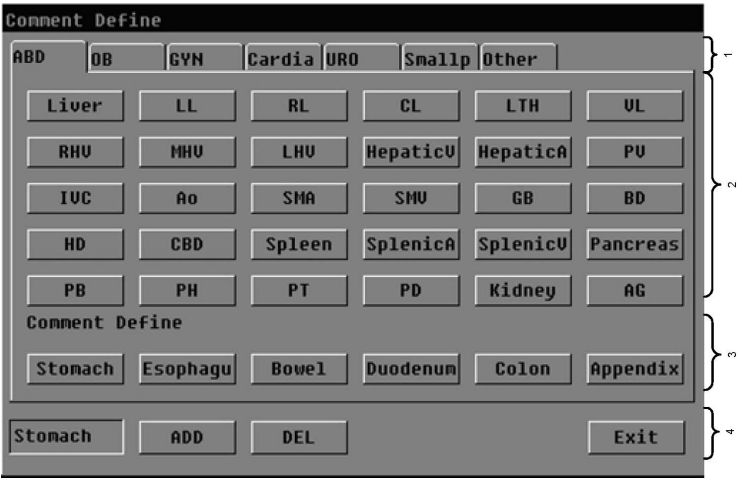


Figure 3.8: Comment Define: customize annotation items

The Comment Setting window can be divided into the following 4 areas:

1. Tabs of application modes.
2. Predefined annotations.
3. User defined annotations: User can add at most 6 annotation items.
4. User operations.

The instructions for adding and removing the annotation items are shown below.

Selection	Click a user defined annotation item to select it.
Edit	Modify the string using the alphanumeric keyboard.
ADD	Add the string as a new user defined annotation item.
DEL	Delete the selected annotation item.
Exit	Exit the <i>Comment Define</i> window.

3.6.6 System Update

You can update the system using USB connection.

Take the following precautions before update:

- Power supply must *not* be interrupted while updating the system.
- Do *not* disconnect the USB drive during the system update.
- The USB drive for system update must be USB 2.0 compatible. The USB drive should contain only the update files which must be saved in the root directory.

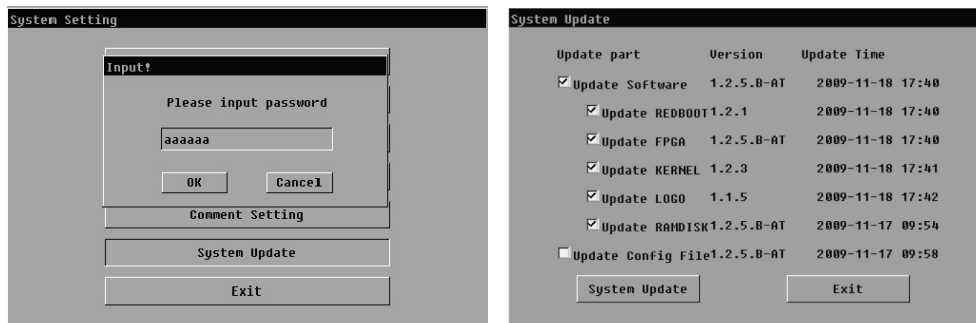


Figure 3.9: System update

Follow these procedures to update the system:

1. Save the update files in the root directory of the USB drive.
2. Turn on the ultrasound system. When the EXAM screen appears, press **MENU** to activate the *System Setting* window.
3. Click **System Update**, enter the password, aaaaaa by default, and press **OK** to open the *System Update* window.
4. Select the parts to be updated, refer to Figure 3.9, and click **Update** to start updating the system. This step takes about 10 minutes.
5. When the cursor changes back to its arrow-like shape, you should restart the system.
6. After the restart, re-open the *System Update* window.
7. Select only **Update Config** and click **System Update** to update the configuration file.
8. Restart the system after the update completes.

**Attention!**

To find the system information including the software version number, see Sub-section 3.6.1. For new users, please update the system only under the guidance of our service engineers.

3.7 Patient Information

Press **Patient** to activate the *Patient Information* window. Click **Save** to save the current patient information. Click **Exit** exit without saving changes.

Patient info

Name: Sex: Height: cm

ID: Age: Weight: kg

ClinicNo: BedNo: Office:

LMP:
(YYYYMMDD)

Comment:

Tel:

Address:

Memo:

Figure 3.10: Patient Information

The *Patient Information* window comprises the following information:

Name	Type the name of the patient here.
Sex	The gender of the patient.
Height	The height of the patient in centimeters.
ID	The patient ID can be combinations of letters and numbers.
Age	The age of the patient must have no more than 3 digits.
Weight	The weight of the patient in kilograms.
Clinic No.	Keep the length less than 10 characters.
Bed No.	The Bed No. must have no more than 3 digits.
LMP	Select the date of the first day of the last menstrual period (LMP).

Office	Select your office or department type here. If OB is selected, the estimated date of delivery (EDD) will be calculated from LMP and be displayed.
Comment	Enter comments here. You can type up to 80 characters.
More	Click this button to expand the <i>Patient Information</i> window and enter more detailed information about the patient. Click this button again to collapse the <i>Patient Information</i> window.


3.8 Add Comments/Annotations

In the application mode, either during the real time scan or with the frozen image, press **COMMENT** to start the annotation mode. Press this key again to exit the annotation mode.



Figure 3.11: Annotation selection

Operations available in the annotation mode are explained below.

Manual Edit	In the annotation mode, typed text will be inserted at the cursor position.
Insert Predefined String	In the annotation mode, press ESC to activate the annotation item selection window, see Figure 3.11. Click an item to add the item on the ultrasound image.
Move Annotation	Move the cursor over an annotation item, when the cursor changes to  , press SET . Move the cursor to a new position and press SET to place the annotation item there.
Delete Annotation	Move the cursor over an annotation item, press Backspace to delete the item. Press Clear to remove all annotation items from the ultrasound image.

3.9 Disk Management

Use *Disk Management* to manage the data both on the local and external drives.

Press **File** to activate the *Disk Management* window. To exit, press **File** again.

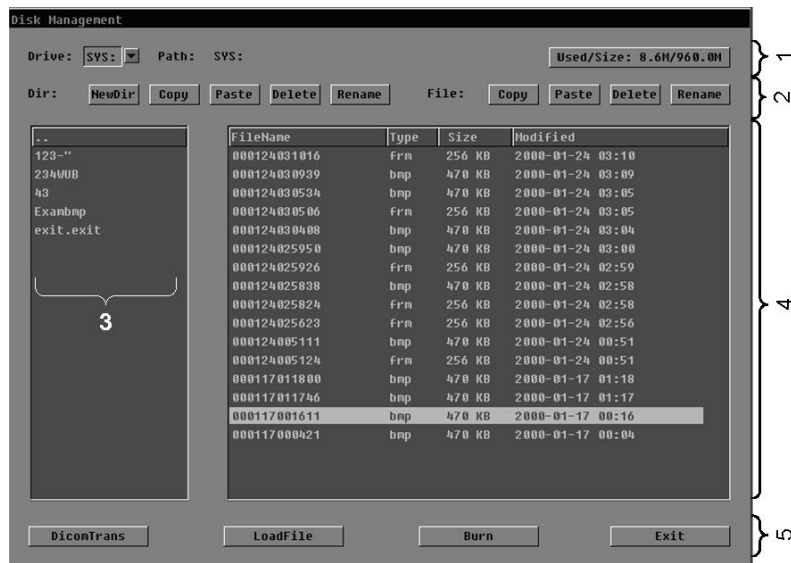


Figure 3.12: Data management

Disk Management window consists of 5 areas, showing the following information:

- 1. The current disk drive, the working path, and the disk usage information.
- 2. Operations can be applied to directories and files.
- 3. File folders in current directory.
- 4. Files in current directory.
- 5. Other operations.

Hint

Use ESC instead of SET to select multiple files or file folders.

Instructions for using Disk Management are shown below:

Drive Select a disk drive from the dropdown list to open. The current working path and the disk usage information are also shown in this row.

Operations applied to directories:

NewDir Click this button and enter a name to create a new directory (file folder).

Copy and Paste Select a file folder, click **Copy**. Go to the target directory and click **Paste** to paste the folder into the directory.

Delete	Select a file folder, click this button to delete it.
Rename	Click it to rename the selected file folder. Two file folders must not have the same name.
Parent Directory	Click ‘.’ to go to the parent directory.

Operations applied to files:

Copy and Paste	Select a file, click Copy . Go to the target directory and click Paste to paste the file into the directory.
Delete	Select a file, click this button to delete it.
Rename	Click it to rename the selected file. Two file files must not have the same name.

Other operations:

Dicom Trans	If the DICOM package is installed, click this button to transfer the selected file(s) through DICOM.
FTP access*	You can also access the data stored on the ultrasound system using a PC through FTP. Read instructions in Figure 3.13 to make connection and configurations.
Load File	Click this button to view the selected file.
Delete	Select a file, click this button to delete it.
Burn	Click this button to activate the file burning window, see Figure 3.14. Instructions are introduced in subsection 3.9.1.

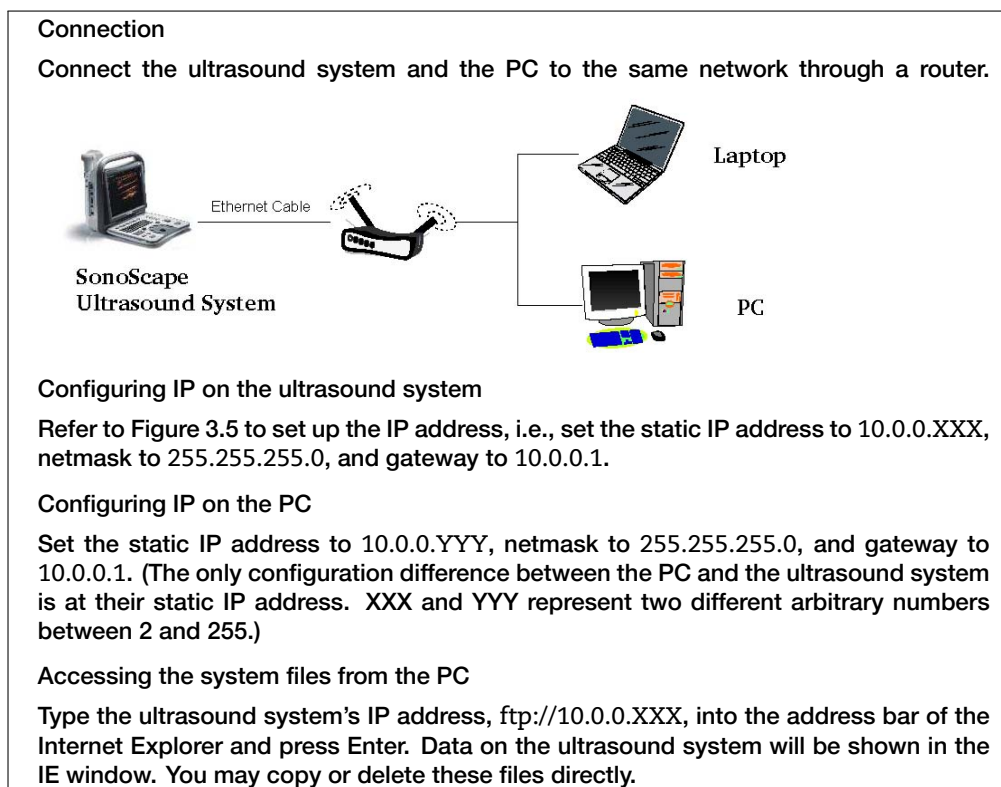


Figure 3.13: Connection and configuration for FTP access

3.9.1 File Burning

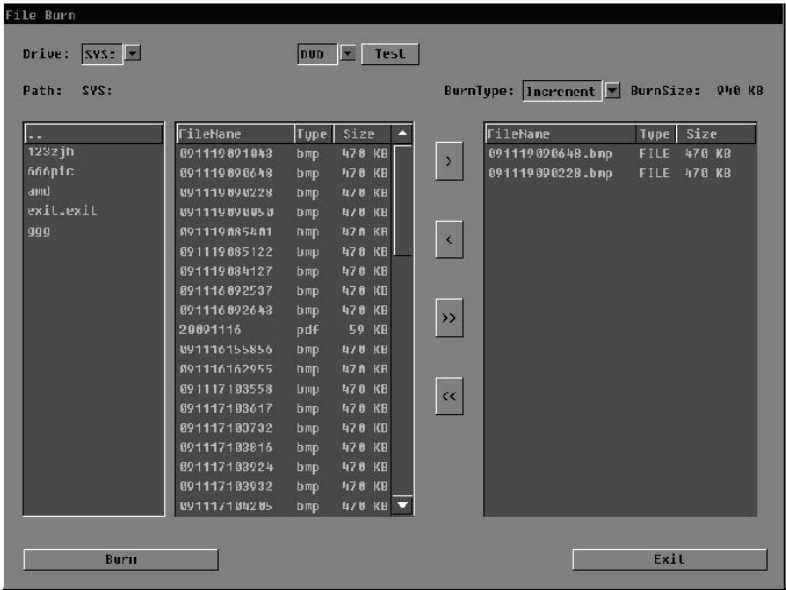


Figure 3.14: File burning window

Click **Burn** at the *Disk Management* window to open the *File Burn* window. The following operations are available:

- Test

Select the media type from the dropdown list, click **Test**. The CD/DVD information, including the available free space will be displayed.
- > / >>

Click > to add the selected file to the burning buffer. Click >> to add all the files and folders in the current directory to the burning buffer. The total size of the files to be burned (BurnSize) should be no more than the free space available on the CD/DVD.
- < / <<

Select a file in the burning buffer window, click < to remove the files from the buffer. Click << to clear all the files and folders from the buffer.
- Burn

Click it to start Burning files. Data can be added to a single disc later if the BurnType is set to Increment.

3.10 Bodymark

Press **BodyMark** in an application mode to activate the *BodyMark* window.

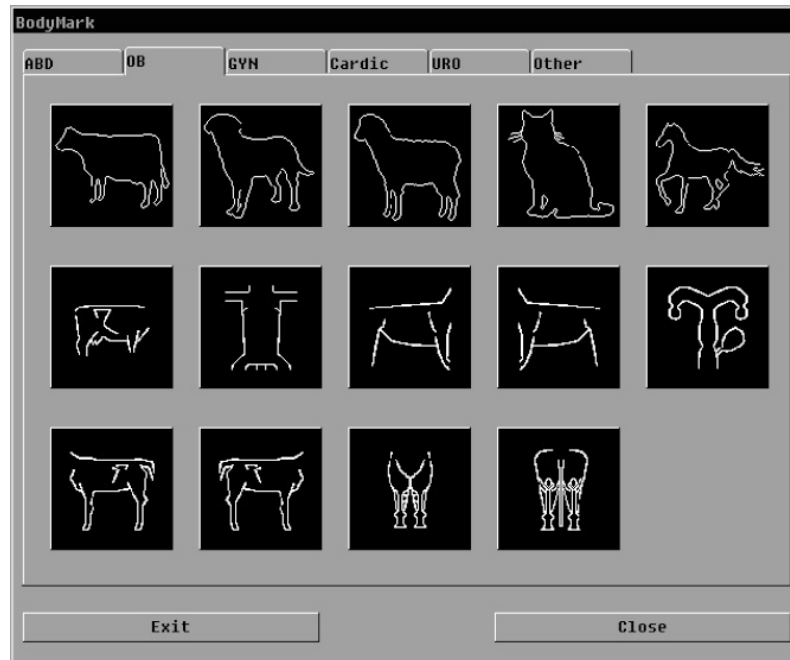


Figure 3.15: Bodymark

Instructions for adding/removing bodymark symbols are shown below:

Insert	In the <i>BodyMark</i> window, click an application mode tab to view the corresponding bodymark symbols. Click on a symbol to insert the symbol on the ultrasound image. Move the trackball to change the probe marker position; turn MENU to rotate the probe marker. Press SET to end the bodymark insertion. Note that inserting a new bodymark symbol also removes the previous one.
Move	Move the cursor over the symbol, press ESC . A white-line box appears around the symbol. Move the cursor to the target position and press SET .
Delete	Press BodyMark to re-activate the <i>BodyMark</i> window, click Exit to close the <i>BodyMark</i> window and remove the bodymark symbol inserted on the ultrasound image. Click Close if you do not want to remove the symbol.

3.11 Biopsy

During the real time scan, press **MENU** to activate the context menu. Select **Biopsy**, turn **MENU** to switch **Biopsy** on. The angle and the position of the biopsy line can be adjusted using the options shown below.

Biopsy adjustments are shown below:

Position	Highlight Position , turn MENU to move the biopsy lines.
Angle	Highlight Angle , turn MENU to rotate the biopsy lines.



Figure 3.16: Biopsy

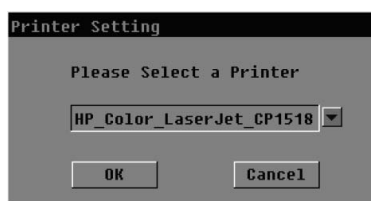
3.12 Report

In the application mode, press **Report** to activate the *Report* window, see Figure 3.17. Click **Exit** to close the window.

The operation of Report is shown below:

Save Click **Save** and enter a name in the popup window to save the report. You can use the *Disk Management* to review the saved report files.

PrinterSet Click **PrinterSet** and select the appropriate printer model.



Print and PDF export Click **Print** to activate the *Print* window, see Figure 3.18. You may add the doctor's comments and the ultrasound images into the report here. Click **Print** to print out the report. Click **SaveReport** to export the report in PDF format.

3.13 Peripherals

3.13.1 USB Devices

Using the generic USB connection, the system supports many peripherals, including removable disk drive, CD writer, USB mouse, and etc.

Note:

We recommend using branded USB drives, Kingston for example, for patient data storage. Certain devices, e.g., external CD/DVD writers, may draw large electric current; please provide these devices with independent power supply.

Report

Hospital: Sonoscape Date: 2009 11 19 09:17:05

Name: pic Sex: F Height: HR: 0 bpm

ID: 665 Age: Weight: BSA: 0.00m²

OB GYN URO D Cardiac M Cardiac Smallpart

	Value	GA	Formula		Value	GA	Formula
GS				CRL			
BPD				HC			
AC				FL			
OFD				FTA			
OPAD				CER			
RA				HUM			
ULNA				TIBIA			
PAD				TAD			
				NI	0.0mm		
Average		EDD(AUA)					
LMP		EDD(LMP)					
FHR		CI	0.0%	HC/AC		FL/AC	
AFI	0.0mm	CFV	0.6			FL/BPD	

Comment:

PrinterSet Print Save Growth Curve Cancel

Figure 3.17: Report

Print

Hospital: Sonoscape Date: 2009-12-30 11:00:39

Name: Sex: F Height: HR: 0 bpm

ID: Age: Weight: BSA: 0.00m²

Perf.Phys.: Sonogr.: Modify

Please Insert Image, Maximum: 4 Brightness < 2 >

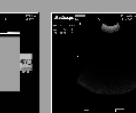
1

2

3

4









Doctor Comment:

SavePrint Preview Print Cancel

Figure 3.18: Print report

Guidance for using external USB devices:

USB disk drives	USB disk drives includes flash drives and removable hard drives. When a USB disk drive is connected, the icon  appears at the bottom right corner of the screen. Use the Disk Management window to copy, move or delete files into or from the USB drive. USB drives can be removed after closing the Disk Management window.
External CD/DVD writer	Connect an external CD/DVD writer to the system using the USB connection. Refer to Section 3.9 for burning data to CD/DVD.
USB printer	Connect a printer supported by the ultrasound system using USB cable. The icon  appears at the bottom right corner of the screen. Press Print and make adjustments in the Print dialog. Click Confirm to send the data to the printer.

3.13.2 Foot Switch

Foot switch is ready to use after connected to the ultrasound system.

3.13.3 Video Out

The ultrasound system has the following connectors on-board: VGA, S-VIDEO, and a Composite Video connector. Ultrasound images can be easily displayed on other external monitors using these connectors.

The most popular standards for Composite video, the format for the analog television signal, are NTSC and PAL. Depending on your geographical location, you may be using one of the two standards, make the configuration accordingly. Refer to Section 3.6.1 for instructions.

To use the video printer, connect it to the Composite Video port using the composite video cable, and to the remote control port using the remote control cable. Press **Print** to trigger the remote video printing.

3.13.4 Network Devices




Connect the device to the ultrasound system using LAN cable, for more configuration details, refer to Section 3.6.2.

3.14 Imaging

3.14.1 Basic Operation

The system supports the following imaging modes: B, 2B, 4B, B/M dual mode, and single M mode, and Tissue Harmonic Imaging (THI). During the real time scan, these basic operations are possible:

B mode	Press B (the B mode key) to activate the single B mode, which is the default imaging mode.
---------------	---

2B mode	Press B/B to activate the 2B mode, the image on the left is active. Press this key again to make the image on the right active and freeze the image on the left.
4B mode	Press 4B () to activate the 4B mode (or quad display mode). Use 4B to change the active ultrasound image.
B/M mode	Press B/M to activate the B/M dual mode. Use B/M to choose the full M mode display or the B/M dual display. The BM Format in Figure 3.4 sets the layout in the B/M dual mode.
THI mode	Press THI to activate or deactivate the Tissue Harmonic Imaging.
Flip horizontally	Press L/R () to flip the active ultrasound image horizontally.
Flip vertically	Press Up/Down () to flip the active ultrasound image vertically.

3.14.2 Parameter Adjustment

The following parameters are adjustable irrespective of the imaging mode.

Frequency	Press Freq. to change the ultrasound frequency of the transducer.
Depth	Press FUNC several times until the Depth function is active. The active function attached to FUNC is displayed at the notification area at the bottom of the screen. Turn FUNC to change the maximum imaging depth.
Focal position	Press FUNC several times until the Focus function is active. Turn FUNC to change the Focal position.
Zoom	Press FUNC several times until the Zoom function is active. Refer to Subsection 3.14.3 for instructions.
Context menu	Press MENU to activate or deactivate the context menu. Move the trackball to select items in the menu. Turn MENU to change the value of the selected item.
Gain	Press Gain to attach this knob to the B mode gain or the M mode gain. Turn Gain to change the B mode gain or the M mode gain.
Time Gain Compensation (TGC)	Slide the TGC controls to change the compensations at the different depths. The TGC curve disappears automatically after 3 seconds, and re-appears once the TGC controls are changed.

The following B mode imaging parameters are possible.

Power (BPWR)	The acoustic output power, keep it as small as possible.
Frequency (BFREQ)	The ultrasound frequency generated by the transducer.
Focal Number (PTN)	The number of focal zones.
Focal Span (SPAN)	The span of the focal zones. Makes sense only if multiple focal zones are present.

Image		Image	
BPWR	70%	PWR	70%
BFREQ	3.5~4.5	FREQ	3.5~4.5
PTN	1	MPER	0
SPAN	1	MSMO	0
LD	High	MENH	0
REGION	63.7	GSC	4
DYN	105	DYN	105
PER	3	REGION	63.7
ENH	1	MSP	4
▼		▼	

Figure 3.19: Context menus of B mode (left) and M mode (right)

Line Density (LD)	The line density of the ultrasound image.
Region (REGION)	This item controls the scan angle for convex array transducers, or the sector width for linear array transducers.
Dynamic Range (DYN)	The dynamic range value.
Persistence (PER)	The B mode persistence value.
Edge Enhancement (ENH)	Edge enhancement number.
Rotation (ROT)	Rotate the active ultrasound image.
GSC (BGSC)	Grayscale curve.
Chroma (BMAP)	The color coding method for ultrasound images.
Analog Gain (A GAIN)	The analog gain of the image.
Biopsy Position Angle	Options for biopsy setup. Refer to Section 3.11.

The following M mode imaging parameters are possible.

Power (PWR)	The acoustic output power, keep it as small as possible.
Frequency (FREQ)	The ultrasound frequency generated by the transducer.
M-Persistence (MPER)	The M mode persistence value.
Smooth (MSMO)	Smoothen the M mode display.
M Enhancement (MENH)	M mode edge enhancement number.
GSC	Grayscale curve.
Dynamic Range (DYN)	The dynamic range value.

Region (REGION)	This item controls the scan angle for convex array transducers, or the sector width for linear array transducers.
Sweep speed (MSP)	The speed at which the M-curve refreshes.
SLOPE	Slope.

3.14.3 Zoom

In the single B mode with the default orientation, i.e., without rotation or flip, the image can be zoomed. Follow instructions below to use the zoom function.

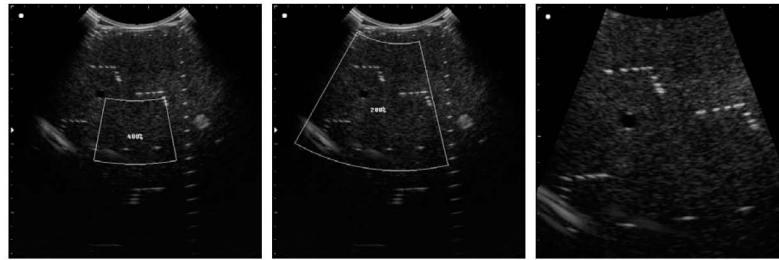


Figure 3.20: Zoom

Activate the zoom function	Press FUNC several times until the Zoom function is active. A box (Figure 3.20) appears on the ultrasound image.
Zoom factor	Turn FUNC to change the magnification factor.
Zoom area	Move the trackball to change the zoom area.
Zoom in	Press SET to zoom in the area enclosed by the zoom box.
Readjust	When the image is magnified, move the trackball to move the zoom box, turn FUNC to change the magnification factor.
Turn off zoom function	Press FUNC to turn off the zoom function.

Measurements

B mode measurement and calculation menus are shown in Figure 4.1 and Figure 4.1.

4.1 B Mode Basic Measurements

The basic measurements in B mode includes:

- Distance
- Angle
- Ratio
- Area and circumference
- Volume

4.1.1 Distance

Description: To measure the length of a line segment.

Instructions:

1. In B mode, press **Distance**.
2. Draw a line segment: Use the trackball to move the cursor to the start point of the measurement and press **SET** to fix the marker; Move the cursor to the end point of the measurement and press **SET**.
3. The result of the distance measurement will be displayed. If necessary continue to measure another distance in the same manner.

4.1.2 Angle

Description: To measure the angle between two line segments (0° to 180°).

Instructions:

1. Press **Calc**, highlight **Angle** and press **SET**.
2. Draw two line segments.
3. The length of the two line segments and the angle between them will be displayed. If necessary continue to measure another group of line segments.

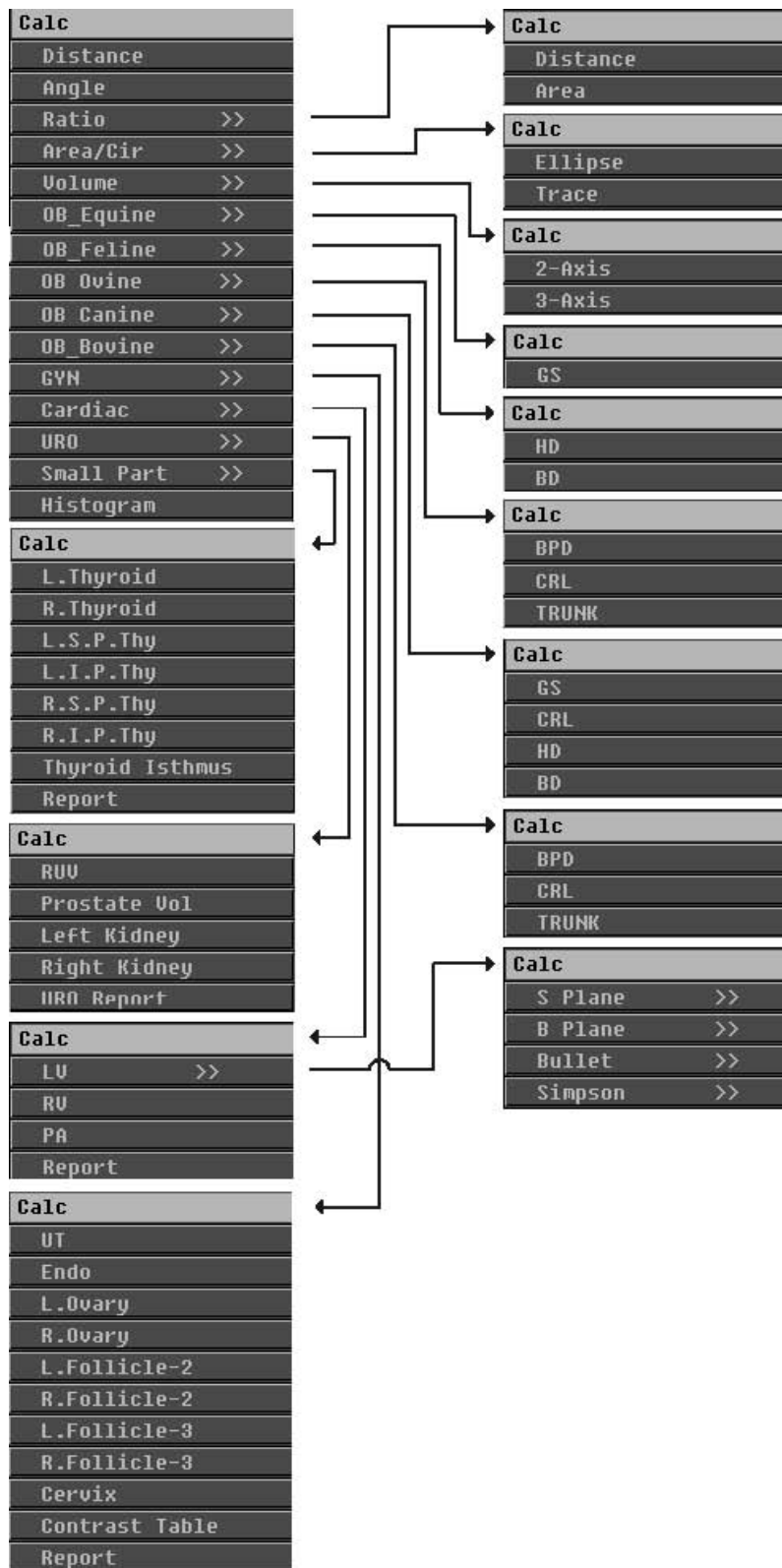


Figure 4.1: B mode measurement and calculation menus (part one)

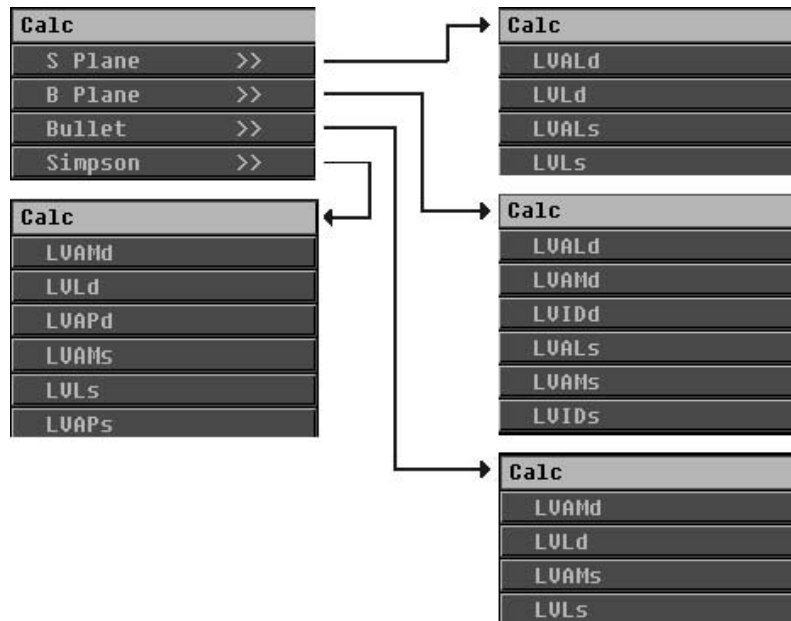


Figure 4.2: B mode measurement and calculation menus (part two)

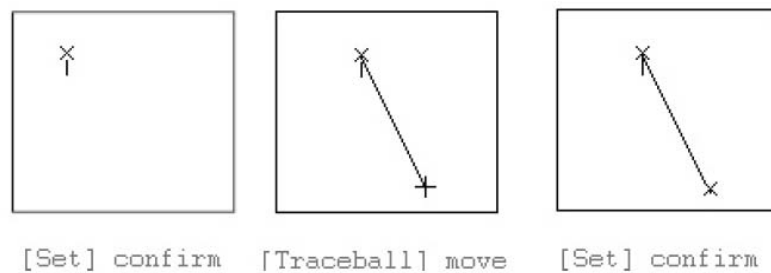


Figure 4.3: Distance Measurement

4.1.3 Ratio

Description: To calculate the ratio of two distances or areas.

Instructions to calculate the ratio of two distances:

1. Press **Calc**, highlight **Ratio** and press **SET**.
2. Highlight **Distance** and press **SET**.
3. Draw two line segments.
4. The ratio, i.e., the length of the first line segment divided by the length of the second line segment, will be displayed. If necessary continue to calculate another ratio.

Instructions to calculate the ratio of two areas:

Measure two areas, the ratio will be the first area divided by the second area. Refer to 4.1.4 for measuring areas.

4.1.4 Circumference and Area

Description: To calculate circumference or area of ellipse or other shapes (drawn using the **Trace** function).

For ellipse:

1. Press **Calc**, highlight **Area/Circ** and press **SET**.
2. Highlight **Ellipse** and press **SET**.
3. Draw a line segment which represents the major axis of the ellipse.
4. Use the trackball to change the length of the minor axis and press **SET** to fix the minor axis.
5. The circumference and the area of the ellipse will be displayed. If necessary continue to calculate the circumference and area of another ellipse.

For other shapes:

1. Press **Calc**, highlight **Area/Circ** and press **SET**.
2. Highlight **Trace** and press **SET**.
3. Move the cursor to the start point of trace and press **SET**. Starting from this point, move the cursor along the edge of target area. Press **SET** to close the trace: the first and last points will be connected with a straight line.
4. The circumference of the closed trace and the area enclosed by the trace will be displayed. If necessary continue to calculate the circumference and area of another shape.

Note: To prevent calculation error, avoid self-intersection when drawing the trace.

4.1.5 Volume

Volume of ovoid can be calculated using 2-Axis or 3-Axis methods.

2-Axis

Description: To measure a globe-like volume using one ellipse. The following formula is used to calculate the volume. A is the length of the major axis, B is the length of the minor axis.

$$V = \frac{\pi}{6} \times A \times B^2$$

Instructions:

1. Press **Calc**, highlight **Volume** and press **SET**.
2. Highlight **2-Axis** and press **SET**.
3. These two steps draws an ellipse. Draw a line segment representing the major axis of the ellipse.
4. Draw another line segment representing the minor axis of the ellipse.
5. The volume will be displayed. If necessary continue to measure another volume.

3-Axis

Description: To measure a globe-like volume using three distances. The following formula is used to calculate the volume. D_1 , D_2 and D_3 are the length of three mutually perpendicular axes.

$$V = \frac{\pi}{6} \times D_1 \times D_2 \times D_3$$

Instructions:

1. Press **Calc**, highlight **Volume** and press **SET**.

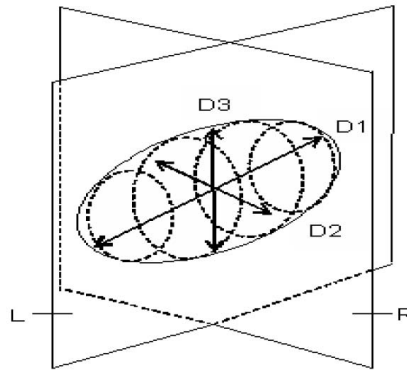


Figure 4.4: A ovoid with its three axis displayed

2. Highlight 3-Axis and press **SET**.
3. Draw three line segments which represent the three axes of the ovoid.
4. The volume will be displayed. If necessary continue to measure another volume.

4.2 B Mode Advanced Measurements

The B mode advanced measurements include:

- OB measurements
- Gynecology measurements
- Cardiology measurements
- Urology measurements
- Small parts measurements

4.2.1 OB Measurements

Gestational Sac (GS) measurement

Description: To measure the Gestational Sac and calculate the Gestational Age (GA).

Instructions:

1. Press **Calc**, highlight **OB.Equine** (for equine) or **OB.Canine** (for canine) and press **SET**.
2. Highlight **GS** in the submenu and press **SET**.
3. Draw a line segment representing the GS diameter.
4. The GS diameter and the GA will be displayed. The GA is calculated using the formula table defined in the system.

Crown-Rump Length (CRL) measurement

Description: To measure the crown-rump length (CRL) and calculate the Gestational Age (GA).

Instructions:

1. Press **Calc**, highlight **OB.Ovine** (for ovine), **OB.Canine** (for canine) or **OB.Bovine** (for bovine), and press **SET**.
2. Highlight **CRL** in the submenu and press **SET**.
3. Draw a line segment to measure the CRL.

4. The CRL and the GA will be displayed.

Biparietal Diameter (BPD) measurement

Description: To measure the biparietal diameter (BPD, the transverse diameter of the head) and calculate the Gestational Age (GA).

Instructions:

1. Press **Calc**, highlight **OB.Ovine** (for ovine) or **OB.Bovine** (for bovine), and press **SET**.
2. Highlight BPD in the submenu and press **SET**.
3. Draw a line segment to measure the BPD.
4. The BPD and the GA will be displayed.

Head Diameter(HD) measurement

Description: To measure the head diameter of the embryo.

Instructions:

1. Press **Calc**, highlight **OB.Feline** (for feline) or **Canine** (for canine), and press **SET**.
2. Highlight AC in the submenu and press **SET**.
3. Draw an ellipse (refer to Section 4.1.4).
4. The HD will be displayed.

Body Length (BD) measurement

Description: To measure the length of the body and calculate the GA.

Instructions:

1. Press **Calc**, highlight **OB.Feline** (for feline) or **Canine** (for canine), and press **SET**.
2. Highlight FL in the submenu and press **SET**.
3. Draw a line segment to measure the FL.
4. The BD and the GA will be displayed.

Trunk measurement

Description: To measure the trunk length and calculate the GA.

Instructions:

1. Press **Calc**, highlight **OB.Ovine** (for ovine) or **OB.Bovine** (for bovine), and press **SET**.
2. Highlight OFD in the submenu and press **SET**.
3. Draw a line segment to measure the OFD.
4. The trunk length and the GA will be displayed.

4.2.2 Gynecology Measurements (GYN)

Uterus (UT)

Description: To measure the length (UT-L), width (UT-W) and height (UT-H) of uterus and calculate UT. $UT = UT-L + UT-W + UT-H$ (in units of centimeters).

Instructions:

1. Press **Calc**, highlight **GYN** and press **SET**.
2. Highlight UT in the submenu and press **SET**.
3. Draw a line segment to measure UT-L.
4. Continue to measure UT-W and UT-H in the same manner.

5. The measurement results and UT will be displayed.

Endometrium Thickness (Endo)

Description: To measure the thickness of endometrium.

Instructions:

1. Press **Calc**, highlight **GYN** and press **SET**.
2. Highlight **Endo** in the submenu and press **SET**.
3. Draw a line segment representing the endometrium thickness.
4. The measurement thickness of the endometrium will be displayed.

Volume of Left and Right Ovaries (L. Ovary, R. Ovary)

Description: To measure the length, width and height of the left and right ovaries, and calculate the volume of the left and right ovaries.

The volume of the ovaries is calculated using the following formula,

For left ovary:

$$L.OV - V = 0.523 \times LtL(mm) \times LtH(mm) \times LtW(mm)$$

For right ovary:

$$R.OV - V = 0.523 \times RtL(mm) \times RtH(mm) \times RtW(mm)$$

Instructions:

1. Press **Calc**, highlight **GYN** and press **SET**.
2. Highlight **L. Ovary** or **R. Ovary** in the submenu and press **SET**.
3. Draw a line segment to measure the length of the left or right ovary.
4. Continue to measure the width and height of the left or right ovary.
5. The measurement results and the left or right ovary volume will be displayed.

Ovary Follicles: Two Distances (L.Follicle-2, R.Follicle-2)

Description: To measure the left and right ovary follicles with two distances.

Instructions:

1. Press **Calc**, highlight **GYN** and press **SET**.
2. Highlight **L.Follicle-2** for measuring the left follicle, or **R.Follicle-2** for measuring the right follicle; press **SET**.
3. Draw a line segment to measure the first distance.
4. Continue to measure the next distance in the same manner.
5. The measurement results will be displayed.

Ovary Follicles: Three Distances (L.Follicle-3, R.Follicle-3)

Description: To measure the left and right ovary follicles with three distances.

Instructions:

1. Press **Calc**, highlight **GYN** and press **SET**.
2. Highlight **L.Follicle-3** for measuring the left follicle, or **R.Follicle-3** for measuring the right follicle; press **SET**.
3. Draw a line segment to measure the first distance.
4. Continue to measure the next two distances in the same manner.

4. MEASUREMENTS

5. The measurement results will be displayed.

Cervix

Description: To measure the length, width and height of the cervix.

Instructions:

1. Press **Calc**, highlight **GYN** and press **SET**.
2. Highlight **Cervix** and press **SET**.
3. Draw a line segment to measure the length of the cervix.
4. Continue to measure the next two distances in the same manner.
5. The measurement results will be displayed.

Gynecology Report

Description: To activate the Gynecology **Report** window. It is equivalent as pressing **Report**, see Section 3.12.

4.2.3 Cardiology Measurements

Left Ventricular (LV) Function Assessment

The measurement items for assessing left ventricular function are listed below:

Left ventricular long axis area at end-diastole	LVALd
Left ventricular long axis length at end-diastole	LVLd
Left ventricular long axis area at end-systole	LVALs
Left ventricular long axis length at end-systole	LVLs
Left ventricular short axis area at mitral valve at end-diastole	LVAMd
Left ventricular short axis diameter at end-diastole	LVIDd
Left ventricular short axis area at mitral valve at end-systole	LVAMs
Left ventricular short axis diameter at end-systole	LVIDs
Left ventricular short axis area at papillary muscle at end-diastole	LVAPd
Left ventricular short axis area at papillary muscle at end-systole	LVAPs

Table 4.1: Measurement items for LV function assessment

The following calculation items and formulae are involved:

Calculation item	Formula	Unit
End-diastolic volume (EDV) of left ventricle	EDV	ml
End-systolic volume (ESV) of left ventricle	ESV	ml
Stroke volume (SV)	SV = EDV-ESV	ml
Cardiac output (CO)	CO = SV×HR	l/min
Ejection fraction (EF)	EF = SV/EDV	
Stroke index (SI)	SI = SV/BSA	
Cardiac index (CI)	CI = CO/BSA	l/(min·m ²)
Fractional shortening (FS) of left ventricle	FS = (LVIDd-LVIDs)/LVIDd	
Mean ventricular circumference fractional shortening	MVCF = (LVIDd-LVIDs)/(LVIDd×ET)	

Table 4.2: Calculation items for LV function assessment

Where,

for Asian, $BSA = WT \times 0.425 \times HT \times 0.725 \times 73.58 / 1000$

for European, $BSA = WT \times 0.425 \times HT \times 0.725 \times 71.84 / 1000$

Body weight (WT) and height (HT) are expressed in kilograms and centimeters respectively.

Measurement and calculation methods for left ventricular available in B mode are:

- Single-plane ellipse (SPellipse)
- Bi-plane ellipse (BPEllipse)
- Bullet
- Simpson

SPellipse

Items to be measured: LVALd, LVLd, LVALs, LVLs

Items to be calculated: EDV, ESV, SV, CO, EF, SI, CI

Formula:

$$EDV = \frac{8}{3} \times \frac{LVALd^2}{\pi \times LVLd}$$

$$ESV = \frac{8}{3} \times \frac{LVALs^2}{\pi \times LVLs}$$

Measurement instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **Cardiac** and press **SET**.
3. Highlight LV and press **SET** to open the submenu; highlight S Plane in the submenu and press **SET**.
4. Measure LVALd, refer to Section 4.1.4 for instructions.
5. Measure LVLd, refer to Section 4.1.1 for instructions.
6. Re-scan the patient in the appropriate plane.
7. Measure LVALs, refer to Section 4.1.4 for instructions.
8. Measure LVLs, refer to Section 4.1.1 for instructions.
9. The measurement and calculation results will be displayed.

BPEllipse

Items to be measured: LVALd, LVAMd, LVIDd, LVALs, LVAMs, LVIDs

Items to be calculated: EDV, ESV, SV, CO, EF, SI, CI

Formula:

$$EDV = \frac{8}{3} \times \frac{LVALd \times LVAMd}{\pi \times LVIDd}$$

$$ESV = \frac{8}{3} \times \frac{LVALs \times LVAMs}{\pi \times LVIDs}$$

Measurement instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **Cardiac** and press **SET**.
3. Highlight LV and press **SET** to open the submenu; highlight B Plane in the submenu and press **SET**.
4. Measure LVALd, refer to Section 4.1.4 for instructions.
5. Measure LVAMd, refer to Section 4.1.4 for instructions.
6. Measure LVIDd, refer to Section 4.1.1 for instructions.
7. Re-scan the patient in the appropriate plane.
8. Measure LVALs, refer to Section 4.1.4 for instructions.
9. Measure LVAMs, refer to Section 4.1.4 for instructions.
10. Measure LVIDs, refer to Section 4.1.1 for instructions.
11. The measurement and calculation results will be displayed.

Bullet

Items to be measured: LVAMd, LVLd, LVAMs, LVLs

Items to be calculated: EDV, ESV, SV, CO, EF, SI, CI

Formula:

$$EDV = \frac{5}{6} \times LVLd \times LVAMd$$

$$ESV = \frac{5}{6} \times LVLs \times LVAMs$$

Measurement instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **Cardiac** and press **SET**.
3. Highlight LV and press **SET** to open the submenu; highlight Bullet in the submenu and press **SET**.
4. Measure LVAMd, refer to Section 4.1.4 for instructions.
5. Measure LVLd, refer to Section 4.1.1 for instructions.
6. Re-scan the patient in the appropriate plane.
7. Measure LVAMs, refer to Section 4.1.4 for instructions.
8. Measure LVLs, refer to Section 4.1.1 for instructions.
9. The measurement and calculation results will be displayed.

Simpson

Items to be measured: LVAMd, LVLd, LVAPd, LVAMs, LVLs, LVAPs

Items to be calculated: EDV, ESV, SV, CO, EF, SI, CI

Formula:

$$EDV = \frac{LVLd}{9} \times (4 \times LVAMd \times +2 \times LVAPd + \sqrt{LVAMd \times LVAPd})$$

$$ESV = \frac{5}{6} \times LVLs \times LVAMs$$

Measurement instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **Cardiac** and press **SET**.
3. Highlight LV and press **SET** to open the submenu; highlight Bullet in the submenu and press **SET**.
4. Measure LVAMd, refer to Section 4.1.4 for instructions.
5. Measure LVLd, refer to Section 4.1.1 for instructions.
6. Re-scan the patient in the appropriate plane.
7. Measure LVAMs, refer to Section 4.1.4 for instructions.
8. Measure LVLs, refer to Section 4.1.1 for instructions.
9. The measurement and calculation results will be displayed.

Right Ventricular (RV) Internal Diameter

Description: To measure the internal diameter of right ventricle.

Instructions:

1. Press **Calc**, highlight **Cardiac** and press **SET**.
2. Highlight RV and press **SET**.
3. Draw a line segment to measure the internal diameter of the RV.
4. The measurement result will be displayed.

Internal Diameter of Pulmonary Artery (PA)

Description: To measure the internal diameter of pulmonary artery.

Instructions:

1. Press **Calc**, highlight **Cardiac** and press **SET**.
2. Highlight PA and press **SET**.
3. Draw a line segment to measure the internal diameter of the PA.
4. The measurement result will be displayed.

Cardiology Report

Description: To activate the *Report* window for writing cardiology report. Refer to Section 3.12.

4.2.4 Urology Measurements

Residual Urine Volume (RUV)

Description: To measure the three axial distances (Length, Width, Height) of the bladder and estimate the bladder volume.

Bladder Volume = $0.7 \times \text{Length} \times \text{Width} \times \text{Height}$.

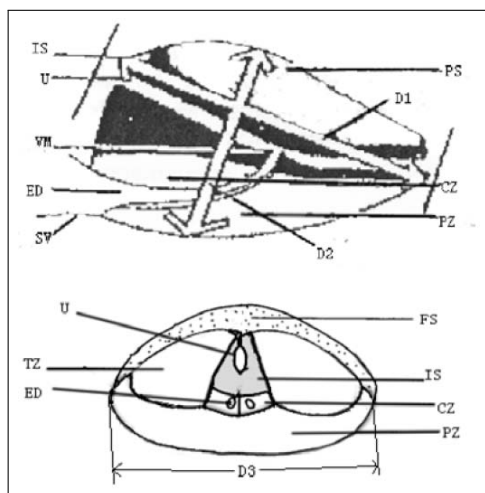
Instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **URO** and press **SET**.
3. Highlight RUV and press **SET**.
4. Draw a line segment to measure Length.
5. Draw a line segment to measure Width.
6. Draw a line segment to measure Height.
7. The measurement and calculation results will be displayed.

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Prostate Volume (PV)

Description: To measure the three axial distances (D1, D2, D3) of the prostate and estimate the prostate volume.



D1: anteroposterior diameter
D2: longitudinal diameter
D3: transverse diameter

$$\text{Prostate Volume (PV)} = \frac{\pi}{6} \times D1 \times D2 \times D3.$$

Prostate-specific antigen density

$$\text{PSAD} = \text{PSA} / \text{PV}$$

Where PSA, or the prostate-specific antigen, is expressed in *ng*. User can provide this value, or otherwise it is $\text{PSA} = 0.12 \times \text{PV}$.

Instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **URO** and press **SET**.
3. Highlight **PV** and press **SET**.
4. Draw a line segment to measure Length.
5. Draw a line segment to measure Width.
6. Draw a line segment to measure Height.
7. The measurement and calculation results will be displayed.

Left and Right Kidney Volumes

Description: To measure the three axial distances (D1, D2, D3) of the left or right kidney and estimate the left or right kidney volume.

$$\text{Kidney Volume} = \frac{\pi}{6} \times D1 \times D2 \times D3.$$

Instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **URO** and press **SET**.
3. Highlight **Left Kidney** for measuring the left kidney, or highlight **Right Kidney** for measuring the right kidney; then press **SET**.
4. Draw a line segment to measure Length.
5. Draw a line segment to measure Width.
6. Draw a line segment to measure Height.
7. The measurement and calculation results will be displayed.

Urology Report

Description: To activate the **Report** window for writing urology report. Refer to Section 3.12.

4.2.5 Small Part Measurements

Volume of Left and Right Thyroid Lobes

Description: To measure the three axial distances (D1, D2, D3) of the left or right thyroid gland and estimate the left or right thyroid volume.

Thyroid Volume = $0.520 \times \text{Length} \times \text{Width} \times \text{Height}$.

Instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **Small Part** and press **SET**.
3. Highlight **L. Thyroid** for measuring the left thyroid lobe, or highlight **R. Thyroid** for measuring the right thyroid lobe; then press **SET**.
4. Draw a line segment to measure Length.
5. Draw a line segment to measure Width.
6. Draw a line segment to measure Height.
7. The measurement and calculation results will be displayed.

Volume of Parathyroid Gland

Description: To measure the three axial distances (D1, D2, D3) of the parathyroid gland and estimate the volume.

Parathyroid Volume = $0.520 \times \text{Length} \times \text{Width} \times \text{Height}$.

Instructions:

1. Scan the patient in the appropriate plane.
2. Press **Calc**, highlight **Small Part** and press **SET**.
3. Highlight **P. Thyroid** and press **SET**.
4. Draw a line segment to measure Length.
5. Draw a line segment to measure Width.
6. Draw a line segment to measure Height.
7. The measurement and calculation results will be displayed.

4.3 M Mode Measurements

The measurements available in M and B + M modes are shown in Figure 4.5.

4.3.1 M Mode Basic Measurements

Distance Measurement in M Mode

Description: To measure the distance between two points on the M mode image.

Instructions:

1. In M mode or B + M mode, press **Calc**, highlight **Distance** and press **SET**.
2. Move the cursor to the start point, and press **SET**.
3. Move the cursor to the end point and press **SET**.
4. The measurement result will be displayed. If necessary continue to measure another distance in the same manner.

Time Measurement

Description: To measure the time between two points on the M mode image.

Instructions:

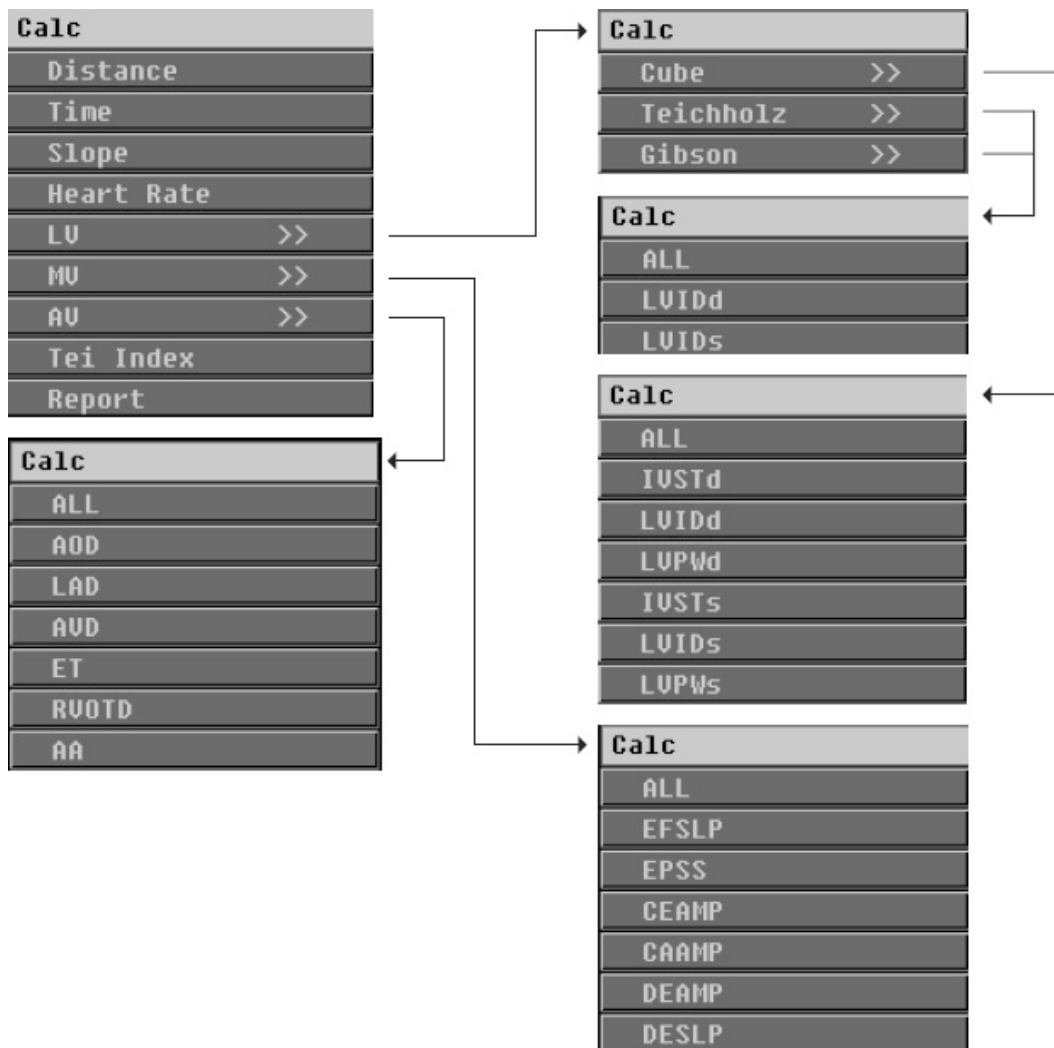


Figure 4.5: M mode measurement and calculation menus

1. In M mode or B + M mode, press **Calc**, highlight **Time** and press **SET**.
2. Move the cursor to the start point, and press **SET**.
3. Move the cursor to the end point (only horizontal movement is possible), and press **SET**.
4. The measurement result will be displayed.

Slope

Description: To measure the slope (velocity) of a line across two points.

Instructions:

1. In M mode or B + M mode, press **Calc**, highlight **Slope** and press **SET**.
2. Move the cursor to the start point and press **SET**. The slope measured from the cursor position to the start point is displayed on the screen.
3. Move the cursor to the end point and press **SET**.
4. The measurement result will be displayed.

Heart Rate

Description: To calculate the heart rate by placing two points.

Instructions:

1. In M mode or B + M mode, press **Calc**, highlight **Heart Rate** and press **SET**.
2. Move the cursor to the start point of the period and press **SET**. The heart rate measured from the cursor position to the start point is displayed on the screen.
3. Move the cursor to the end point of the period and press **SET**.
4. The distance and the time duration between the two points and the heart rate will be displayed.

4.3.2 M Mode Advanced Measurements**Left Ventricular (LV) Function Assessment**

Refer to Table 4.1, Table 4.2 and Table 4.3 for the definitions of the measurement and calculation items. To assess the LV function in M mode, three different formulae are possible: Teichholz formula, Cube formula and Gibson formula.

Left ventricular wall thickness of the inter-ventricular septum at end diastole	IVSTd
Left ventricular wall thickness of the posterior wall at end diastole	LVPWd
Left ventricular wall thickness of the inter-ventricular septum at end systole	IVSTs
Left ventricular wall thickness of the posterior wall at end systole	LVPWs

Table 4.3: Measurement and calculation items for LV assessment in M mode

Teichholz formula

Items to be measured: LVIDd, LVIDs, ET

Items to be calculated: EDV, ESV, SV, CO, EF, SI, CI, MVCF, FS

Formula:

$$EDV = \frac{7 \times LVIDd^3}{2.4 + LVIDd}$$

$$ESV = \frac{7 \times LVIDs^3}{2.4 + LVIDs}$$

Measurement instructions:

1. Press **Calc**, highlight **LV** and press **SET**.
2. Highlight **TEICHHOLZ** and press **SET**.
3. Draw a line segment to measure LVIDd.
4. Draw a line segment to measure LVIDs.
5. Perform a standard time measurement to measure ET.
6. The measurement and calculation results will be displayed.

Cube formula

Items to be measured: IVSTd, LVIDd, LVPWd, IVSTs, LVIDs, LVPWs, ET

Items to be calculated: EDV, ESV, SV, CO, EF, SI, CI, MVCF, FS

Formula:

$$EDV = LVIDd^3$$

$$ESV = LVIDs^3$$

Measurement instructions:

1. Press **Calc**, highlight **LV** and press **SET**.
2. Highlight **CUBE** and press **SET**.
3. Draw a line segment to measure IVSTd.
4. Draw a line segment to measure LVIDd.
5. Draw a line segment to measure LVPWd.
6. Re-scan the patient in the appropriate plane.
7. Draw a line segment to measure LVIDs.
8. Draw a line segment to measure LVPWs.
9. Perform a time measurement (page 47) to measure ET.
10. The measurement and calculation results will be displayed.

Gibson formula

Items to be measured: LVIDd, LVIDs, ET

Items to be calculated: EDV, ESV, SV, CO, EF, SI, CI, MVCF, FS

Formulae:

$$EDV = \frac{\pi}{6} \times (0.98 \times LVIDd + 5.90) \times LVIDd^2$$

$$ESV = \frac{\pi}{6} \times (1.14 \times LVIDs + 4.18) \times LVIDs^2$$

Measurement instructions:

1. Press **Calc**, highlight **LV** and press **SET**.
2. Highlight **GIBSON** and press **SET**.
3. Draw a line segment to measure LVIDd.
4. Draw a line segment to measure LVIDs.
5. Perform a time measurement to measure ET.
6. The measurement and calculation results will be displayed.

Mitral Valve (MV)

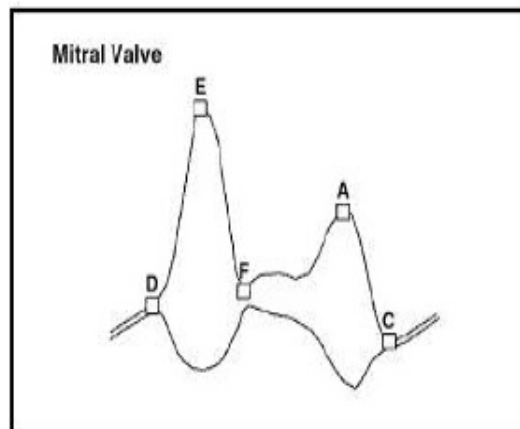


Figure 4.6: MV measurements

Description: To measure the E-wave amplitude (CEAMP), DE-wave amplitude (DEAMP), A-wave amplitude (CAAMP), mitral valve opening speed (DESLP), and mitral valve closing speed (EFSLP); and to calculate the ratio of A-wave and E-wave (A/E).

Instructions:

1. In M mode or B + M mode, press **Calc**, highlight **MV** and press **SET**.
2. Highlight **CEAMP** and press **SET**. Perform a standard M mode distance measurement to measure CEAMP.
Highlight **DEAMP** and press **SET**. Perform a standard M mode distance measurement to measure DEAMP.
Highlight **CAAMP** and press **SET**. Perform a standard M mode distance measurement to measure CAAMP.
Highlight **DESLP** and press **SET**. Perform a standard M mode distance measurement to measure DESLP.
Highlight **EFSLP** and press **SET**. Perform a standard M mode distance measurement to measure EFSLP.
3. The measurement and calculation results will be displayed.

Aortic Valve (AV)

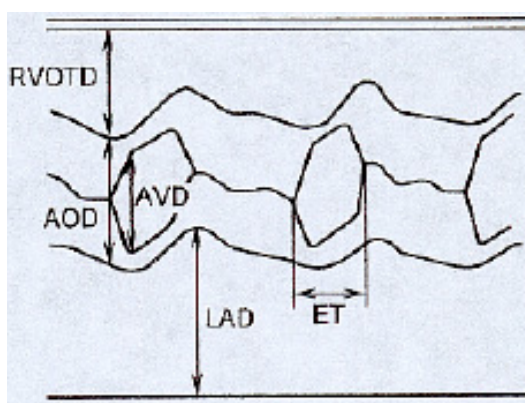


Figure 4.7: AV measurements

The following items will be measured in the AV measurement:

AOD	Aortic diameter
LAD	Left atrium diameter
AVD	Aortic valve bore diameter
ET	Ejection time
RVOTD	Right ventricular outflow tract diameter
AA	Aortic amplitude

The following items will be calculated:

Item	Description	Formula
LA/AO	Left atrium aorta ratio	LAD/AOD
AVSV	Aortic valve stroke volume	$MAVO1 + MAVO2$
	Where MAVO1 and AA are ...	

Instructions:

1. In M mode or B + M mode, press **Calc**, highlight **AV** and press **SET**.
2. Highlight **AOD** and press **SET**. Perform a standard M mode distance measurement to measure AOD.
3. Highlight **LAD** and press **SET**. Perform a standard M mode distance measurement to measure LAD.

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4. Highlight **AVD** and press **SET**. Perform a standard M mode distance measurement to measure AVD.
5. Highlight **ET** and press **SET**. Perform a standard time measurement to measure ET.
6. Highlight **RVOTD** and press **SET**. Perform a standard M mode distance measurement to measure RVOTD.
7. Highlight **AA** and press **SET**. Perform a standard M mode distance measurement to measure AA.
8. The measurement and calculation results will be displayed.

Tei Index

Description: To calculate the Tei index by measuring the isovolumic contraction time (ICT), the ejection time (ET) and the isovolumic relaxation time (IRT) and using the following formula:

$$TEI = (ICT + IRT)/ET$$

Instructions:

1. In M mode or B + M mode, press **Calc**, highlight **Tei Index** and press **SET**.
2. Highlight **ICT** and press **SET**. Perform a standard time measurement to measure ICT.
3. Highlight **IRT** and press **SET**. Perform a standard time measurement to measure IRT.
4. The measurement and calculation results will be displayed.

Cardiology Report

Description: To activate the *Report* window for writing cardiology report. Refer to Section 3.12.

Saving/Reviewing

5.1 Saving

To save a customized exam mode, see Subsection 5.1.1.

To save images, see Subsection 5.1.2.

5.1.1 Saving User-defined Exam Mode

Exam modes can be customized and saved and can also be imported from or export to external drives.

Follow instructions below, to customize and save an exam mode.

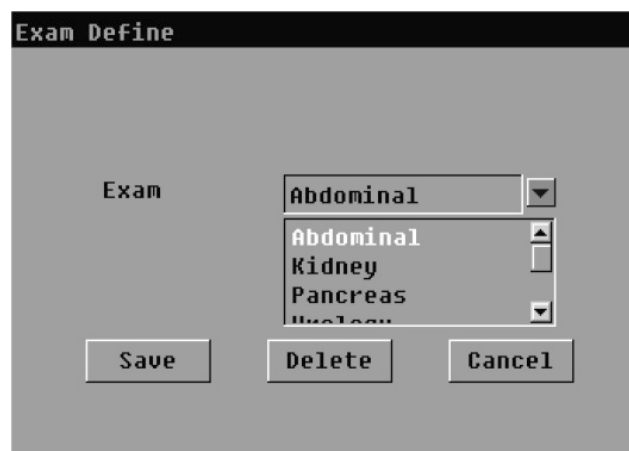


Figure 5.1: Save customized exam mode

1. Select a probe and an exam mode for the probe. Press **Set** to start a real time scan.
2. Adjust the various parameters for the exam mode.
3. Press **SAVE** to open the *Exam Define* window, see Figure 5.1.
4. Select the type of application from the dropdown list. Click **Save** and enter a new name. The icon for this exam mode now appears in the EXAM interface.

*To delete an exam mode, select a user-defined exam mode in Figure 5.1 and click **Delete**. You can only delete user-defined exam modes.*

*To export User-Defined Exam Modes to an external USB drive, insert the USB drive into the USB port of the ultrasound system, then click **Export to USB**. The user can provide a name*

for the backup file, e.g. 'XX'. The system will backup all exam modes to a single file with the file name USEREXAM-XX.uem and save it on the USB drive.

To import User-Defined Exam Modes from an external USB drive, insert the USB drive with the .uem file, click on the **Import from USB** button to import the User-Defined Exam Modes from the USB drive.

5.1.2 Saving Images

In freeze mode, press **SAVE** to activate the **Save Image** window. Click **Exit** to close the window. Or click other buttons to save images or cine. The meaning of these buttons are explained below:

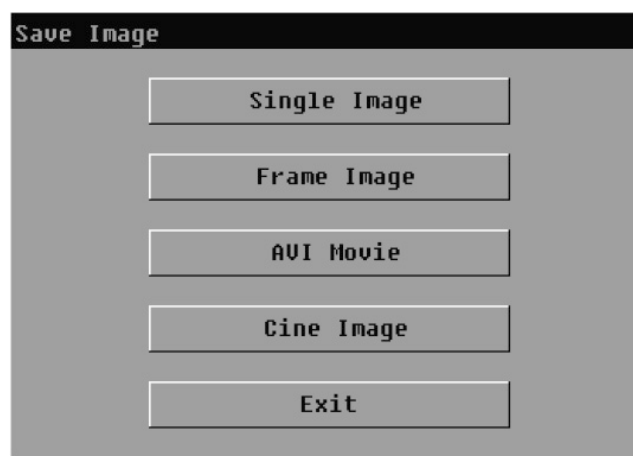


Figure 5.2: Save images and video

Single Image	Click this button to save the image in DCM, JPEG or BMP format. The image will be saved into either the patient folder which is named with the patient ID, or, if no patient profile is active, the root directory on the system drive.
Frame Image	Click this button to save the image in FRM format. The image will be saved into either the patient folder, or, if no patient profile is active, the root directory on the system drive.
AVI Movie	Click this button to save the cine sequence as AVI movie. At most 512 frames can be saved. Note that the AVI movie can only be saved into external USB disk drive.
Cine Image	Click this button to save the cine sequence in CINE format. At most 512 frames can be saved. Note that the cine can only be saved to external USB disk drive.
Shortcut Keys	In cine mode, press M to save .bmp image; press J to save .jpg image; press F to save .frm image; press D to save .dcm image.

5.2 Cine Review

Press **FREEZE** during a real time scan to freeze the image and start the cine mode. At most 512 frames can be recalled.

Frame by frame review

In cine mode, move the trackball slowly to review the cine loop frame by frame. The frame number for the current frame is shown at the cine playback status bar.

Cine loop playback

In cine mode, move the trackball fast forward to start the cine loop playback. Move the trackball again to stop the playback.

5.3 M Mode Cine Review

Operations for the cine review in M mode are the same as in B mode.

In B/M duplex cine mode, the B mode image and the M mode trace are updated simultaneously.

5.4 Clipboard

In cine mode, press **Clipboard** to start the clipboard tool which provides quick access to the saved images. The **Clipboard** shows five thumbnails of the most recently saved images. Move the trackball to look for the images saved even earlier.

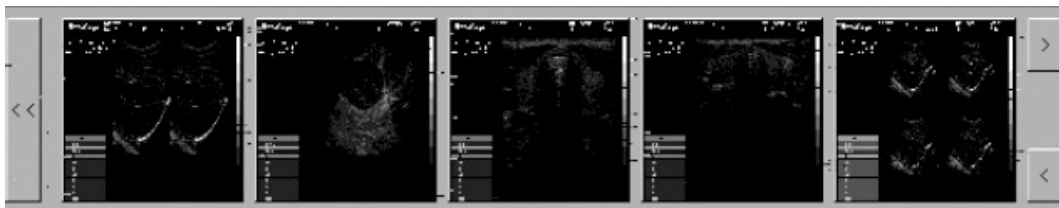


Figure 5.3: Clipboard

Click > to view the next image (saved less recently).

Click < to view the previous image (saved more recently).

Press **Clipboard** again or click << to close the **Clipboard** window.

5.5 Note for Biplane Transducers

When using a biplane transducer, the system shows ultrasound images for one scan plane by default. To view the ultrasound images for the other scan plane, press **B** on the alphanumeric keyboard.

Press **B/B** to activate the dual display which shows the ultrasound images for the two scan planes simultaneously. Since only scan in one plane is possible, images in one of the two windows must be frozen. Press **B** on the alphanumeric keyboard to stop scanning the current plane and scan the other plane.

Transducers

This ultrasound system supports a wide range of probes which make the system remarkably versatile. This chapter provides the transducer information and the guidance for the use and maintenance of the transducers.

6.1 Transducer Information

6.1.1 Supported Transducers and Intended Applications

The transducers supported by this ultrasound system are listed non-exhaustively in Table 6.1.

Model	Main applications
C351/2-6MHz / Convex	Abdominal, GYN/OB
C352/2-6MHz / Convex	Abdominal, GYN/OB
C543/3-8MHz / Convex	Abdominal, Pediatric
L745/5-11MHz / Linear	Small parts
L746/5-11MHz / Linear	Small parts, Superficial
C312/2-5MHz / Micro-convex	Cardiology
C612/4-9MHz / Micro-convex	Pediatric, Veterinary
6V5/4-9MHz / TV, Micro-convex	GYN
EC2/4-9MHz / EC, Micro-convex	Endocavitary

Table 6.1: Transducer list

6.2 Environmental Requirements

The transducers should be used with that the following environmental requirements has been satisfied.

	Operation	Storage and transport
Relative humidity	30%~75%, no condensation	20%~90%, no condensation
Ambient temperature	10°C~40°C	-20°C~55°C
Barometric pressure	700hPa~1060hPa	700hPa~1060hPa

6.3 Preparation and Usage of the Probe

6.3.1 Inspection

After each use, or before first use or after long-time storage of the probe, the probe must be examined for any damages listed in the table below. Stop using the probe if any damage is found. Contact your representative for servicing asap.

Possible damage types
Cracks on the probe handle (user section).
Cracks on the probe head (applied section).
Scratches on the probe head (acoustic window surface).
Swell of the acoustic window material.
Cracks or wear on the probe cable.
Cracks on the probe connector or any other kinds of visible damage.
Deformed pins or broken pins exist inside the probe connectors.

6.3.2 Probe Connection

Refer to Section 3.2 for detailed information on probe connection.

6.3.3 Preparation for Scanning



Attention!

- An effective acoustic coupling does not require inordinate pressure, but it does require coupling gel and patient contact.
- Check the expiration date of the probe sheath and the coupling gel. Never use expired probe sheath and coupling gel.
- Latex or natural rubber contained inside medical equipments or accessories can cause severe allergic reactions in some individuals. It's suggested by FDA that the user should identify the latex-sensitive patients and be prepared to treat allergic reactions promptly.
- Only water-soluble coupling gel should be applied to the probe head surface. Avoid contact with the mineral oil.

For Surface Probes

Put an adequate amount of coupling gel either on the probe head (acoustic window) or the patient skin.

If disease transmission is a concern, use of the sterile probe sheath is highly recommended. Refer to instructions below to use the probe sheath as a barrier between the patient and the transducer surface.

For intracavitary probes

Note: The probes are provided in non-sterile condition from the manufacturer.



Intracavitary probes should be cleaned and disinfected both before and after usage.

1. To prevent disease transmission, wear sterile gloves.
2. Put an adequate amount of coupling gel on the probe head or into the probe sheath.
3. Insert the transducer into the probe sheath.



Use of sterile, legally marketed probe sheath is required for intracavitary operations. If lubricant is used, it must be water-soluble. Do not apply coupling gel directly on the patient skin.

4. Cover the probe with the probe sheath up to the user section (probe handle).
5. Examine the integrity of the probe sheath. If breakage occurs, repeat from step 1 to replace the sheath with another new one.

6.3.4 Scanning

Refer to Chapter 3 to turn on the system and start an ultrasound diagnosis.

6.4 Probe Maintenance: Cleaning and Disinfection

Clean the transducer and the probe handle after each use.

For surface probes, disinfect the transducer periodically. For intracavitary probes, disinfecting the transducer after each use is required.

Keep a log of maintenance (inspection, cleaning and disinfection) and malfunction.

6.4.1 Probe immersion level

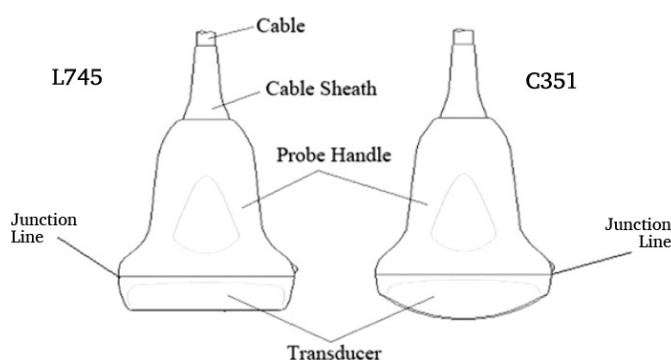


Figure 6.1: Surface probes

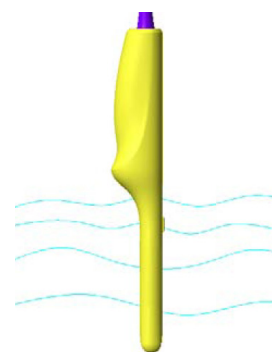


Figure 6.2: Intracavitary probe

For surface probes, do not immerse the probe beyond its junction line (refer to Figure 6.1).

For intracavitary probes, the allowed immersion level is shown in Figure 6.2.



Warning!

- DO NOT use solutions containing alcohol, mineral oil for cleaning or disinfecting probes.
- Wear medical sterile gloves to prevent potential disease transmission. Wear protective goggle if necessary.
- DO NOT apply solutions containing ethyl oxides on the probe.

6.4.2 Cleaning Instructions

1. Disconnect the probe from the ultrasound system. Remove the biopsy guide if it is attached to the probe.
2. Remove all the coupling gel and clean the probe with soft cloth and flowing potable water.
3. If the probe surface carries too much residue, remove all visible residue with wet cloth soaked in mild soap water. Use wet soft cloth to scrub the surface if dried residue exists. Remove all soap water residue with damp cloth soaked in potable water.
4. Air dry or dry with a soft cloth.

6.4.3 Disinfection Instructions

The level of disinfection is directly related to the duration of contact with the germicide. High level of disinfection¹ is recommended for surface probes and required for intracavitary probes. Legally marketed liquid chemical germicides (e.g. Cidex) are highly recommended. Prepare and use the germicides following the manufacturer's instructions.



Warning!

- DO NOT use high pressure steam to disinfect the probe.
- DO NOT use thermal disinfection! Temperatures higher than 66°C or 150°F will damage the probe.

1. Ensure that all visible residues have been removed.
2. Prepare the germicide solutions according to the manufacturer's instructions. Please also follow the manufacturer's instructions for storage and disposal of the germicide.
3. Immerse the probe head into the germicide for a time interval specified by the germicide manufacturer. The immersion level should be kept below the junction line. High level disinfection is recommended for surface probes and required for intracavitary probes. Note that you may need to rotate and shake the transducer in order to remove the air bubbles between the transducer surface and the germicide solution.
4. After removing the probe from the germicide solution, rinse it thoroughly with clean, potable water to remove all visible germicide. Dry the probe with a soft cloth.

¹Refer to the germicide manufacturer's instruction to perform high level disinfection.

System Maintenance

We recommend the user to perform the following maintenance operations:

- Clean the probes and probe holders daily to remove coupling gel, dust, and etc.
- Clean the system (keyboard, monitor, and etc.) regularly.



Attention!

- Switch the system off before cleaning.
- Damp cloth soaked in mild soap water is allowed.
- Protect the system, especially the electric parts, from drip water.
- Do not apply acetone/alcohol or use abrasives on the system or the transducer surfaces.

7.1 Guidance for Service

In case of any malfunctions, turn off the system and disconnect the power supply. Contact your SonoScape representative for service. Mention the detailed phenomena of the malfunction to the service personnel to help the identification of cause.



Warning!

There are no user replaceable parts inside the system. Any kind of do-it-yourself repairs invalidate the warranty. Contact your representative for service instead.

7.2 Manufacturer Responsibility

The manufacturer assumes the responsibility with regard to safety, reliability and performance of this product only under the following conditions,

- all installation, hardware and software upgrades, modifications and repairs of this product are performed or instructed by authorized personnel;
- operation, transport and storage of this product are under the required environmental conditions;
- the product is operated in accordance with this user manual.

7.3 Contact Information

Any feedbacks or inquiries concerning our product or service should be directed to the following address.

✉ Contact Information:

Address: 4/F., Yizhe Building, Yuquan Road, Shenzhen, P.R. China

Zip Code: 518051

Tel: 86-400-678-8019

Fax: 86-755-26722850

Website: <http://www.sonoscape.com>

E-mail: service@sonoscape.net

Information of EU Representative

SONOMED

Via Luigino Tandura, 74-00128 Rome, Italy

Tel: + 39-06-5082160

Fax: + 39-06-5084752